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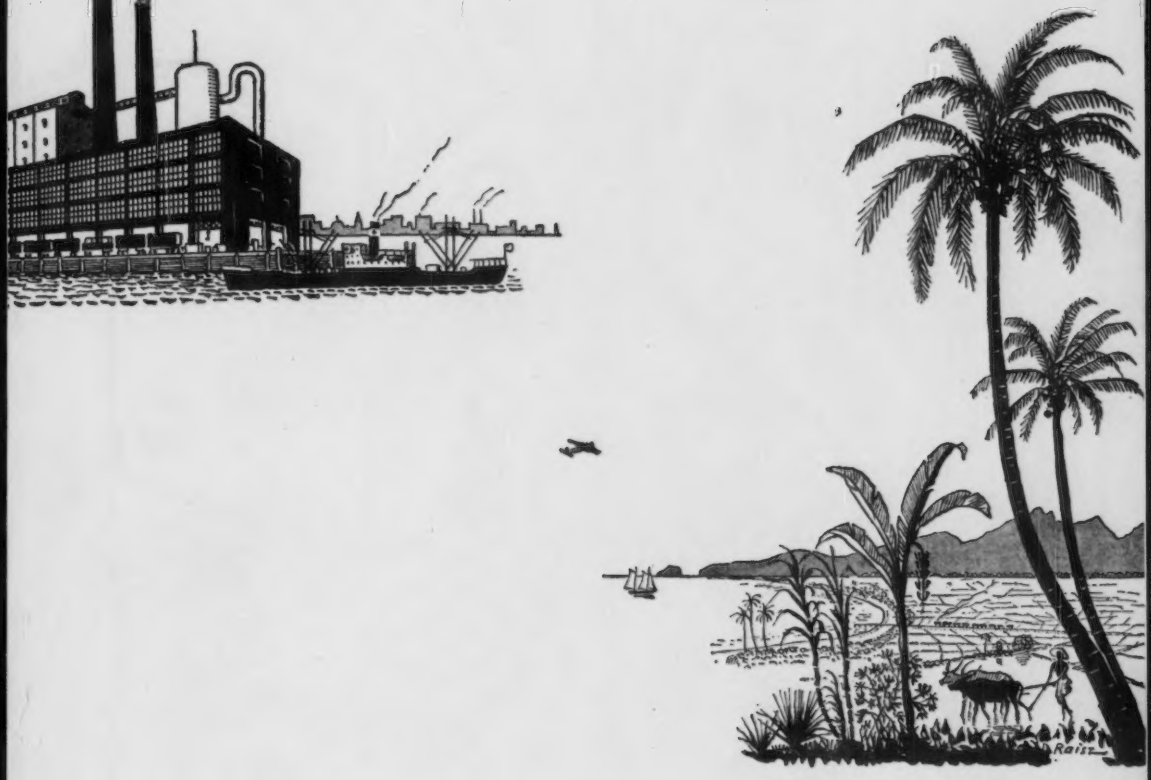
ECONOMIC GEOGRAPHY



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THE QUANTITATIVE BOGEY-MAN

Use of quantitative techniques in economic geography has met with a spate of criticism during the last year. Common complaints are that "*the mechanics of scientific method are mistaken for its soul* (verification) . . . (which) . . . *betrays insecurity, a lack of confidence in one's own work unless decked out in striking but perhaps ill-fitting garments,*" that "*ends are confused with means,*" that quantifiers "*only study the trite,*" "*misiake correlation for causation,*" and "*combine ambition with a pedantic discovery of the known.*" Complaints of this character need careful evaluation in light of what the "quantifiers" are thinking and doing.

The "quantifiers" differentiate between the *facts* with which geography is concerned, *theories* which weave facts into patterns based upon perceived spatial regularities, and *methods* which are used to link facts and theory and to state theory as precisely and concisely as possible. Methods include systematically applied language, maps, logic, and mathematics. Increased use of symbolic logic and mathematics reflects a desire to add to qualitative thought and observation a dimension of formal quantitative thought and observation. This dimension is manifested by statement of concepts and theories in symbolic form and by methodical matching of fact and theory at specified levels of agreement, such that if unreasonable discrepancies are found fundamental revisions of theory are in order. Fact, theory, and method blend into the unified whole of description, analysis, and prediction that characterizes any research undertaking.

The formal approach to geography has been facilitated by focusing research upon systematic analysis of spatial distributions, of the covariations and relationships of spatial distributions, and of spatial structure, interactions, and organization. Little interest is evidenced in the peculiarities of individual places or the integration of diverse facts in area because uniqueness and exceptionalism imply a lack of that generality which the "quantifiers" consider desirable.

In this context complaints against quantification appear ill-directed. Criticisms which imply confusion of correlation with causation and so forth apply *not* to method but to the conceptual basis and theoretical frame of studies: if the trite is studied it implies lack of a worthwhile research problem; discovery of the known signifies unfamiliarity with the available storehouse of concept and generalization; confusion of correlation and cause reveals absence of the theory which enables separation of the spurious from the significant. It is hard to see how such complaints constitute a criticism of quantification. The charge that ill-fitting garments are used may be more germane, for it brings into focus the question of the most efficient tool for the job. But this criticism, like the others, does not imply a quantitative bogey-man. Apparently, complaints really refer to the concepts and theories of the "quantifiers," and more specifically to their preliminary attempts to formalize and test available qualitative concepts and theories and their admitted disregard of the unique in order to establish the bases of a more theoretical geography. Whether or not these complaints are valid or penetrating is, of course, another matter, but evaluation of them should be facilitated by recognizing their real focus.

Constructive criticism of concepts leads to sounder theoretical foundations. Discussion of alternative research strategies leads to greater analytic sophistication. Criticisms which imply a quantitative bogey-man tilt at windmills, however; they confuse theory and method when their real complaint is that the "error" of formal approaches is to ignore facts about the peculiar characteristics and qualities of uniqueness of particular places. The moral is that it is essential to differentiate fact, theory, and method if criticism is to be effective, unambiguous, and constructive.

BRIAN J. L. BERRY

ECONOMIC GEOGRAPHY

VOL. 36 OCTOBER, 1960 NO. 4

AN EVALUATION OF THE STANDARD OF LAND USE IN WESTERN EUROPE

S. Van Valkenburg

Dr. Van Valkenburg is Director of the Graduate School of Geography, Clark University.

THE trend in non-Communist Europe is toward economic cooperation. After many years of conferences and planning the first official step was taken in 1958 by the creation of the "Common Market" which brought Italy, France, Western Germany, and the Benelux countries together, in an economic union to be completed within a period of 12 to 15 years as a goal. Difficulties prevailing between Britain and France with regard to the degree of cooperation, on the question of complete union versus more freedom for the individual countries, led to the founding of the European Free Trade Association in 1959 which has seven members—namely, Britain, the Scandinavian countries, Switzerland, Austria, and Portugal. These two blocs are popularly called the Inner Six and the Outer Seven. This leaves six nations which have not been included in either of the two blocs. Of the six Greece and Turkey have requested associate membership within the Common Market, Ireland has dominant economic ties with Britain, Iceland has the USSR as its major customer, and Finland cannot move without Russian consent.

The case of Spain is a special one. After World War II, Spain was in disrepute because of Franco's attitude during that war. Gradually, the attitude toward Spain has mellowed, and in 1959 it became a member of the Organization of European Economic Cooperation (OEEC). Great efforts are being made to bring the Six and the Seven together, with possible extension to the present outsiders, while even economic cooperation with the United States and Canada is being considered.

This process of economic integration, which includes the field of agricultural production, brings about the necessity of evaluating Western European agrarian production and studying the possible effects of the cooperation on the agrarian economy.

In 1959 the author of this article published a study of land use within the European Common Market as a necessary step toward an understanding of the impact of cooperation on the land use of that area.[1] In the summer of 1959 the survey was extended over the other countries of Western Europe and this article is the result of the investigation.

[1] S. Van Valkenburg: "Land Use within the European Common Market," *Econ. Geog.*, Vol. 35, 1959, pp. 1–24.

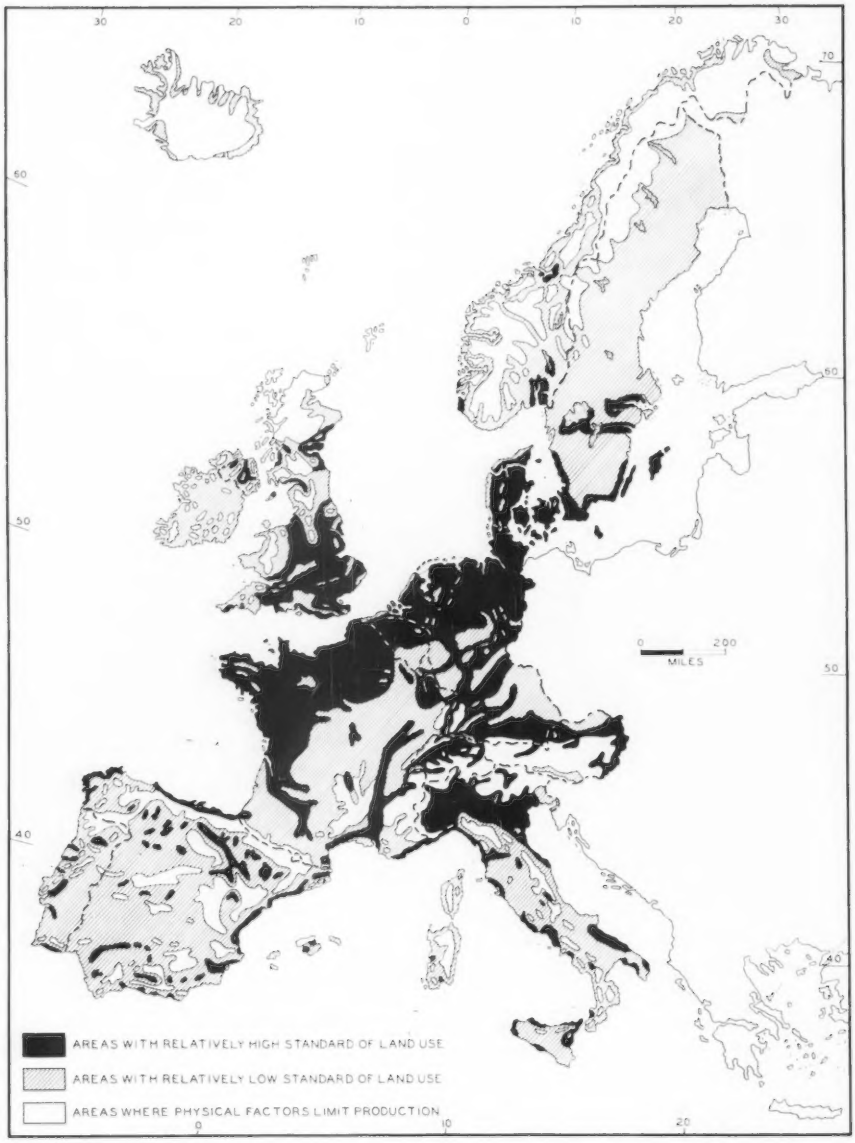


FIG. 1. Standards of land use in Western Europe.

THE MAP OF STANDARDS OF LAND USE IN WESTERN EUROPE

The map of standards of land use covers all of Western Europe (Fig. 1), including the area presented on the map for the Common Market published before. More detailed maps are given for individual areas. The two major

divisions shown on the map, namely the areas of relatively high and relatively low productive value are based, as far as possible, on the gross revenue expressed in dollars per hectare. A value of 300 dollars per hectare was used as the dividing line between them. If no gross revenue data were available, which happened only in a few cases, other criteria such as yield of crops, milk production per cow, or rent value of the land were used. The third category contains those parts of Western Europe where the physical factors of relief and climate permit only limited use of the land. *The lines between categories on the map do not follow political boundaries.*

It should be understood that gross revenue is different from net revenue. The use of net revenue was impossible because information was often lacking, and the definition of net revenue varied greatly. The British Ministry of Agriculture, Fisheries and Food defines the net output as that part of the gross output due to agricultural operations of the farm itself. Purchase of seeds and fodder, which are the output of other farms, are deducted from gross output to arrive at net output. For all types of farms in England and Wales the net output is 25 per cent below the gross output; for dairying alone the difference is 37 per cent. Another point which could not be considered is the buying power of the money. Basic food prices vary greatly from country to country and differences in productive value, for instance, between Switzerland and Austria, are partly offset by lower Austrian food prices.

The areas of relatively high standards of production, which are shown in black on the map, vary greatly although they are all above 300 dollars gross revenue per hectare. For instance, in the case of Switzerland the highest value for a farm type was 753 dollars while the lowest was 327 dollars. It might be possible at a later date to differentiate between a higher and a lower group. In the same way there are wide differences within the category of relatively low standard of land use, lined pattern on the map. In Spain, for instance, the value dropped in part of the southern Meseta to as low as 67 dollars. Perhaps a subdivision can be made later.

The category of relatively low standard of land use (lined pattern on the map) deserves further study based on field work. Not all of these areas can be called submarginal; many of them are important in the economy, especially from the point of view of grazing and for forests and produce up to their capacity. In a few cases such areas are used for recreation—as national parks. However, large parts of southern Europe and even of southern France could be made more productive provided the costs of improvement are not prohibitive. Political reasons (fear of Communism) may also result in improvements such as land reform, but this might be so expensive that it would become a financial burden. Outright abolition of low-producing farmland and return to grazing or forest might be another solution, but often a large population is involved which could not be taken care of otherwise in the national economy.

Tables covering all of Western Europe give a general picture of the relative position of each country and its rate of progress. Table I, showing the structure of land use, gives the percentage standing of each in various items of land use and food production within the totality of Western Europe. These can be compared with the population percentages. For grain, area as well as production is shown, which gives an idea of the national standard of land

TABLE I

STRUCTURE OF LAND USE OF WESTERN EUROPE EXPRESSED IN PERCENTAGES OF THE TOTAL (1957–1958)

(Data mainly from O. E. E. C.)

One per cent of total	*Population 2.85 million*	*Arable land 905,000 ha.*	*Permanent pasture 350,000 ha.*	*Forest 880,000 ha.*	*Bread grain*		*Coarse grain*		*Milk 935,710 metric tons*	*Meat 128,000 metric tons*	*Eggs 28,060 metric tons*	*Sugar 6,650 metric tons*	*Potatoes 73,740 metric tons*
					Area 210,000 ha.	*Production 393,000 metric tons*	*Area 177,000 ha.*	*Production 378,500 metric tons*					
Iceland	0.05	....	0.2	0.1	....	....	....	....	0.04	0.1	0.03	....	....
Norway	1.2	0.9	0.5	8.5	0.1	0.1	1.0	1.2	1.9	1.0	1.1	....	1.5
Sweden	2.6	4.1	0.5	25.5	2.4	2.9	5.7	5.2	4.3	3.0	3.0	4.4	2.1
Denmark	1.6	3.0	0.9	0.5	0.6	1.4	6.6	10.4	5.6	6.6	5.0	4.8	2.4
United Kingdom	18.1	8.9	15.4	4.3	4.3	7.3	12.4	15.4	12.8	16.5	24.4	14.2	9.9
Ireland	1.0	1.6	9.4	0.8	0.8	1.2	1.7	2.1	2.8	3.5	1.7	1.6	3.2
Netherlands	3.8	1.2	3.6	1.1	1.1	2.0	1.5	2.3	6.4	5.0	9.4	6.0	5.3
Belgium-Luxemburg	3.2	1.1	2.1	1.4	1.4	2.4	1.5	2.2	4.3	3.8	5.7	5.5	3.0
France	15.5	23.5	36.5	21.7	21.7	22.7	24.3	22.6	22.8	25.9	15.1	23.0	20.5
Germany	18.0	9.6	16.0	12.8	12.8	18.3	11.9	14.6	19.4	20.0	13.1	19.6	33.6
Switzerland	1.8	0.5	2.0	0.6	0.6	0.9	0.3	0.4	3.2	1.9	1.0	0.5	1.7
Austria	2.4	1.9	3.1	2.2	2.2	2.4	2.4	2.3	3.1	2.7	2.4	3.3	4.3
Portugal	3.1	4.6	2.3	5.0	5.0	2.1	5.3	1.6	0.3	1.0	0.8	....	1.5
Italy	17.0	17.3	3.5	23.5	23.5	22.1	16.9	16.8	10.0	7.1	12.4	13.8	4.3
Spain	10.3	22.7	3.6	23.3	23.3	12.4	14.3	7.8	2.7	3.8	4.6	5.5	5.3

TABLE II

CONSUMPTION PER CAPITA

(unit kg.)

	Western Europe (without Spain and Ireland)			*U. S.*	*Highest in Western Europe*	*Lowest in Western Europe*
	Prewar	*1948–1949*	*1957–1958*			
Meat	44.0	30.5	47.0	86.2	69.3 (France)	16.2 (Portugal)
Eggs	8.5	6.9	9.7	20.6	15.2 (Ireland)	2.7 (Portugal)
Fish	15.6	16.8	14.7	4.6	38.4 (Norway)	7.1 (Austria)
Bread grain	110.8	117.2	103.7	55.8	122.3 (Italy)	68.4 (Sweden)
Potatoes	101.8	122.8	96.4	49.4	179.4 (Ireland)	48.0 (Italy)
Vegetables	68.0	73.5	77.7	59.1	123.5 (France)	25.2 (Sweden)
Fruit	38.6	39.9	52.1	44.5	88.3 (Switzerland)	26.2 (Ireland)
Sugar	25.6	23.2	30.7	44.0	47.3 (Denmark)	16.4 (Portugal)
Milk	97.7	96.6	106.9	158.3	227.7 (Norway)	16.5 (Portugal)
Cheese	50.1	4.5	6.3	3.5	8.8 (France)	1.0 (Ireland)
Butter	5.2	3.7	4.9	3.0	16.5 (Ireland)	0.5 (Portugal)
Margerine	3.2	.....	5.7	.....	24.1 (Norway)	2.1 (Switzerland)

Source: O. E. E. C., 1957–1958.

use. If the standard is high the production percentage is well above that of the area (see for instance, Denmark); on the other side, Spain and Portugal, whose production percentages well below those of the area, represent the low standard of production. Production percentages well above the percentage of population do not necessarily indicate a surplus; much depends on the structure of the consumption which varies greatly from country to country (see Table II). Table III, indices of increase of population and increase of agricultural production, is quite revealing although here, also, caution is suggested, as some of the high increases of agricultural production are based on a very low prewar level. A higher increase of agricultural production as compared with the population increase does not necessarily mean self-sufficiency. It only indicates less deficits. Three countries have a higher population increase. In the case of Germany it is based on the postwar influx of refugees. Switzerland seems to have reached its peak of agricultural production and faces greater deficit. Worse is the case of Spain, where the already low food production does not keep up with the increase of population.

PORTUGAL

Although Portugal (Fig. 2), as far as the author could discover, has no data for the gross revenue of the farmland, it was possible to come to fairly satisfactory conclusions by using crop production, crop yields, and the values of those crops as published for Spain. The map shows few areas of a gross revenue above 300 dollars per hectare. Most of these are irrigated valleys pro-

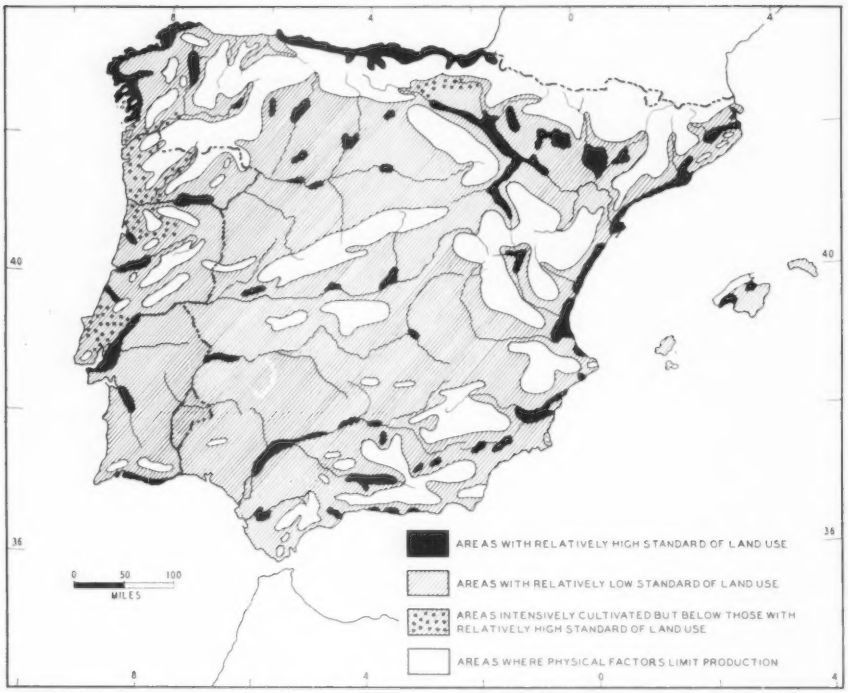
TABLE III

INDICES OF INCREASE OF POPULATION AND INCREASE OF AGRICULTURAL PRODUCTION (1957–1958)

(Prewar 100)

Austria	105	122
Belgium	107	151
Denmark	101	145
France	108	134
Germany	128	123
Iceland	138	...
Ireland	98	122
Italy	112	131
Netherlands	127	133
Norway	109	128
Portugal	117	143
Spain	116	109
Sweden	117	113
Switzerland	122	117
United Kingdom	108	167

Sources: O. E. E. C. and Demographic Yearbook U. N.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AREAS WITH RELATIVELY LOW STANDARD OF LAND USE
AREAS INTENSIVELY CULTIVATED BUT BELOW THOSE WITH RELATIVELY HIGH STANDARD OF LAND USE
AREAS WHERE PHYSICAL FACTORS LIMIT PRODUCTION
0 50 100
MILES

FIG. 2. Standards of land use in Spain and Portugal.

ducing high-yielding rice as well as fruits and vegetables. Also included is the Portwine Region upstream from Porto and the Algarvian Coast, with its subtropical fruit and early vegetables. Perhaps the estimate of the value of that coastal production has been too optimistic.

For the rest of Portugal, not counting the mountain area with its extensive grazing and some forests, the yields of the crops are low, about the lowest in Europe. Table IV gives a comparison between Portugal, Spain, and France in this respect, the last country representing average European conditions.

The low yields of Portugal (rice is the only exception), especially if compared with those of Spain, are quite surprising as the physical conditions of terrain, climate, and soil are not inferior. The reason may be sought in the inherent conservatism of the Portuguese farmer and the attraction of maritime activities. Nevertheless, there are parts of Portugal which give the impression of being intensively cultivated even if the yields are low. The major

TABLE IV

A COMPARISON OF YIELDS OF PORTUGAL WITH THOSE OF SPAIN AND FRANCE

	Portugal	*Spain*	*France*
Wheat*	8.5	9.7	22.5
Rye*	7.1	8.1	12.2
Barley*	5.9	13.3	22.8
Oats*	3.8	8.1	17.5
Corn*	8.5	19.5	24.7
Rice*	43.2	57.5	37.7
Milk**	1450	2030	2010

*Yield per ha. in quintals (1953–1957).
**Milk per cow in liters.

crop economies are wine and corn in the north; wheat, corn, wine, and olives in the central parts. The boundary between corn and wheat as major crops is based on the number of dry months—less than four months for corn and above four months for wheat. The dry season comes in summer. The percentage of land in forest, chiefly pine (resin, turpentine), is quite high between Duero and Tejo. In some parts it amounts to about half of the land.

Spain

The map of Spain (Fig. 2) is based on recent field work and on the data of value of land use, including dairy, provided by the Spanish statistics. The statistical data given by political units (provinces) are fairly complete but one wonders if they are always reliable. The map was checked by the members of the Department of Geography at the University of Zaragoza, Spain's chief geographic center.

There are two types of areas of relatively high productive value in Spain, namely those with and those without irrigation. The non-irrigated areas (Campo Regadio) are found along the northern coast and in Galicia—areas with good rainfall and few, if any, dry summer months. Another area is Catalonia where the rainfall of the Mediterranean type exceeds 20 inches. The irrigated areas are scattered through dry Spain (Campo Secano) and produce crops of high value, varying from sugar beets, tobacco, and even cereals (Ebro Valley) in the north to citrus fruit, dates, rice, cotton, and sugar cane in the south. The percentage of land under irrigation for the whole of Spain is given by Joaquin Bosque (Geografia Economica de Espana, Teide, Barcelona, 1955) as only $3\frac{1}{2}$ per cent of the agricultural land. This figure is too low for the present conditions as much work has been done and several projects are now under construction. The figure given by the F.A.O. is 8 per cent.

The remainder and greater part of Spain is a rather sad story; low yields, low income, and much fallow land. Only a few limited areas of superior wine production (Logrono, Jerez) may reach the higher level.

Statistical data about the income from land use are given by province and a map based on such provincial data gives a totally different picture from the geographical one, as provinces contain areas of different productivity within themselves. For instance, the low value for the province of Granada (95 dollars) is possible in spite of the highly productive vega of Granada which covers only a small percentage of the otherwise generally low-productivity arable land. The high value of the northern provinces (above 300 dollars) is based on low percentages of arable land. Santandar, for instance, has only 7 per cent; the rest is chiefly mountains. Pontevedra, southern Galicia, represents the transition to the adjacent less productive Portuguese province. Catalonia also stands out as relatively productive, as does Valencia where the wide, highly productive coastal plain carries sufficient weight. The areas of low value form a solid bloc south of the dividing range (Sierra de Guadarama) east of the western provinces with somewhat higher rainfall and west of the eastern Mediterranean coast with its irrigation. The lowest is Ciudad Real (only 67 dollars), the chief wine region of Spain, indicating the low value of the local wine production. On the Meseta where relief is a minor factor the percentage of arable land is somewhere between 30 and 45 per cent. This figure would be much higher but for the high percentage of land lying fallow.

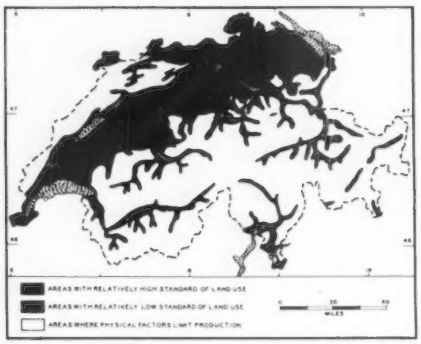
AREAS WITH RELATIVELY HIGH STANDARD OF LAND USE
AREAS WITH RELATIVELY LOW STANDARD OF LAND USE
AREAS WHERE PHYSICAL FACTORS LIMIT PRODUCTION
MILES

FIG. 3. Standards of land use in Switzerland.

Another disadvantage which Spain and Portugal share is the large differences in production from year to year. In the period 1947–1957 cereal production in Spain has been as high as 9,182,000 metric tons and as low as 6,201,000; for Portugal the corresponding figures were 1,778,000 and 1,057,000. A disturbing factor is that the index of total crop production for Spain increased only 10 per cent since 1931–1955 while the population increased 20 per cent.

SWITZERLAND

The standard of land use in Switzerland (Fig. 3) is high; nowhere does the gross revenue go below 300 dollars (±1200 francs) per hectare. A complete survey of 13 different combinations of crop, pasture, and forest is given in the "Statistische Schriften des Schweizerisches Bauern Sekretariates," No. 55, Brugg 1956, II partie). The lowest gross revenue is 1362 francs (pasture economy of the Jura). The highest is 3138—the clover grass (Kleegrass) economy in part of the canton of Bern. Not mentioned are the wine areas along Lac Leman and in Central Wallis, and the horticulture of Saxon in Wallis which are probably even higher in value.

It should not, however, be forgotten that land use is highly protected in Switzerland and that the costs of living are high. In 1957 the farmer received 15 dollars for a quintal of wheat, while in Austria he received only 10 dollars. The sharp drop across the boundary, especially in France and Austria, does not necessarily mean lower living conditions.

On the map, the mountains are indicated by white but even there certain valleys (impossible to show) and mountain slopes are quite productive.

AUSTRIA

The map of standard of land use for Austria must be regarded as a provisional one (Fig. 4). The author had no opportunity to visit Austria during his survey, but hopes to make such a visit in the near future. The difficulty is that for the eight agricultural regions of Austria only two made the 300 dollar gross production value per hectare for 1955–1957 though another one came close. Taking an average for the last four years available (1953–1957) none of them reached the top level. However, increase of production and a general rise of agricultural prices makes it fairly certain that for three of the regions the 300 dollar mark would have been reached, except for climatic inter-

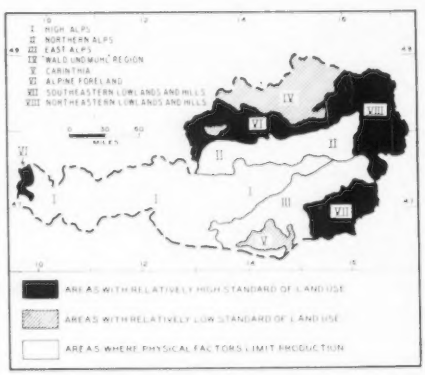
I HIGH ALPS
II NORTHERN ALPS
III EAST ALPS
IV "WALD UND MUHL" REGION
V CARINTHIA
VI ALPINE FORELAND
VII SOUTHEASTERN LOWLANDS AND HILLS
VIII NORTHEASTERN LOWLANDS AND HILLS
MILES
AREAS WITH RELATIVELY HIGH STANDARD OF LAND USE
AREAS WITH RELATIVELY LOW STANDARD OF LAND USE
AREAS WHERE PHYSICAL FACTORS LIMIT PRODUCTION

FIG. 4. Standards of land use in Austria.

ference such as the heavy floods in the summer of 1958. From the point of view of the type of land use the highest values were reached in the wine-crop economy of the northeastern and southeastern plains and hills (Fig. 4), the crop-grass economy of those same areas as well as of the Alpine Foreland, and the grass economy of the Alpine Foreland. The northwestern area (Wald and Mühlviertel), where cropland prevails, has a low standard of land use. The somewhat marginal position of Austria can also be shown by a comparison with Switzerland. Wheat yields drop from 29.3 (Switzerland 1957) to 22.2 for Austria; rye yields from 26.8 to 19.0. Milk yield per cow in 1957 was, for Switzerland, 3220 kg., and, for Austria, 2350 kg. The Austrian farmer receives for his products about two-thirds of the value the Swiss farmer receives, but that is partly offset by the lower price level in Austria. Comparison between the consumption per capita of the two countries shows for Austria a greater emphasis on cereals and less on meat, dairy, fruits, and vegetables. Altogether, Austria ranks well below Switzerland, but the rate of Austrian progress is somewhat higher than the Swiss rate.

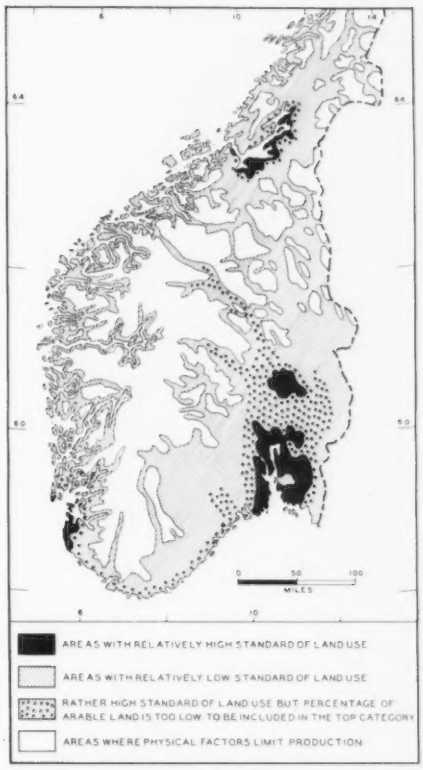
AREAS WITH RELATIVELY HIGH STANDARD OF LAND USE
AREAS WITH RELATIVELY LOW STANDARD OF LAND USE
RATHER HIGH STANDARD OF LAND USE BUT PERCENTAGE OF ARABLE LAND IS TOO LOW TO BE INCLUDED IN THE TOP CATEGORY
AREAS WHERE PHYSICAL FACTORS LIMIT PRODUCTION

FIG. 5. Standards of land use in Norway.

DENMARK

Danish land use is on a very high level and gross revenues are well above the limit of the high category of the map of Standard of Land Use (Fig. 1). Below that level are the dunes along the west coast, some remnants of the former forest-moor landscape in central Jutland, and a complex of forest in northern Sjaelland, which is more a recreational park.

In his publication, Landbrug geografiske Studies over Danmark Köbenhavn, C. A. Reitzels (Forlog 1959), Aa H. Kampp recognizes seven regions which vary in agricultural structure. The increasing importance of barley and mixed grain (barley, oats, rye) is interesting, and, of course, root crops are still the Danish specialty.

NORWAY

The problem in Norway (Fig. 5) was not so much the gross revenue per hectare which in most of Norway except the north is above the limit of 300 dollars because of high milk production, but the limitation of the high category due to a low percentage of farmland. As in Sweden, the limit was taken at 20 per cent farmland and data were available for small units. The map shows three areas: (1) on all sides of

the Oslo Fjord with an exclave to the north in the Hamar area; (2) the Rogaland plain (Stavanger); and (3) a section along the south and east sides of the Throndjem Fjord. Also, the very small strawberry producing area of Lenvik is included.

It was fairly easy from the material available and from field work done by one of the author's graduate students in northern Norway, to draw the limits of that part of Norway where physical factors (terrain, climate) greatly limit production although parts of it can be used for seasonal grazing. The area in between (lined pattern on the map) combines forest, rough pasture, and some rather intensive land use in some of the valley bottoms (improved pasture and barley).

A line can be drawn limiting the area where farming is still important but the percentage of farmland is below 20. That line runs north of the southern coastal zone, surrounds the Oslo area, and extends far inland along some valleys such as Gudbrandsdal and Valdres. Part of the information was obtained from Mr. Arne Thormodsaeter of the Norges Landbrukskonomiske Institutt in Oslo. The low production of bread grain is shown in Table I.

SWEDEN

Gross revenue data for Sweden (Fig. 6) are published by the Kungl. Lantbruksstyrelsen under the title of Rakenskapsresultat. Sweden is divided into agricultural regions and the gross revenue is given for selected farms for different sizes (5–10 ha, 10–20 ha, 20–30 ha, and 30–50 ha). The revenue in all cases decreases with the increasing size of the farm. While certain sections in the south (see black color on the map) are consistently above 15,000 Kroner, there were three regions in central Sweden which exceeded that amount for certain years for small farm areas. With the cooperation of Professor William William-Olsson of the Geografiska Institutionen of the Handelshögskolan in Stockholm, and the help of excellent material in statistics as well as maps, it was possible to indicate those sections which are over and around the critical amount of gross revenue. Those are three in number: the area south of Lake Väner; the strip from Lake Vätter to the Baltic coast (Norrköping), and the land around Lake Mälar extending northward to Upsala. The northern limit of high gross revenues was taken where the farmland became less than 20 per cent of the total land. Some northern farms are quite productive

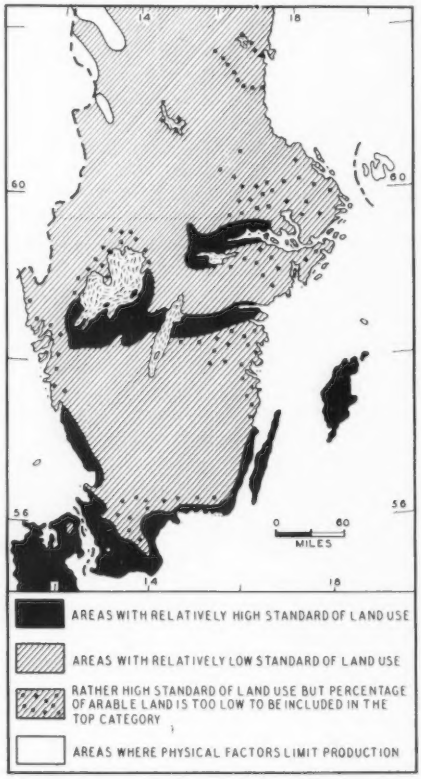

FIG. 6. Standards of land use in Sweden.

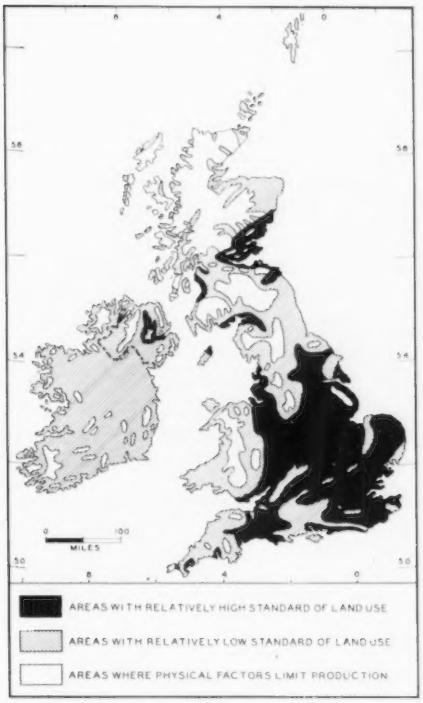

FIG. 7. Standards of land use in the United Kingdom.

using grazing in the forests, but they cover only a small part of the land. Some of the better areas (below 300 dollars or below 20 per cent of farmland) are certain border sections of the Southern Upland, the dairy region north of Lake Väner, the coastal zone along the Baltic (Vastuvik), a large area around the intensive zone of Lake Mälar extending northward, and a limited zone around Lake Siljan and the Östersund-Åre area. The other areas on the map are for the greater part in forest. Along the Norwegian boundaries there are mountains where physical conditions greatly handicap land use.

UNITED KINGDOM

Farm gross revenue data are available for England and Wales, while for Scotland the amount of rent for farmland was used (Fig. 7). The difficulty was that those data (Farm Incomes in England and Wales, Ministry of Agriculture, Fisheries and Food) cover areas which are not specified in map form. Accordingly, the map of standard of land use was drawn with the help of the very complete land use map of Britain (also maps of soil classification and type of farming). The results were checked by Professor L. Dudley Stamp who was responsible for the land use survey of Britain and knows practically every acre of it.

The following types of farming areas were used in the gross revenue survey:

1. Dairying: Gross values were generally well above the level of 300 dollars per hectare with the exception of Northern England, Wales, and the southern Pennines. Dairy, as the name indicates, is the major source of income (in average about 60 per cent of the total).
2. Livestock: Gross values are generally low; in Wales, very low (8 pounds per acre). Exceptions are Midland Grazing and the Wolway Plain. In some sections, dairying is still important but the value obtained from livestock is higher (about 65 per cent of the total).
3. Mixed: This combines crops, livestock, and dairying. Values of production vary. Above the 300 dollars per hectare value are the Southeastern and Southwestern regions, the Vale of York, Holderness, West Midland, and Central Suffolk.
4. Arable (crop economy): On better soils the values are quite high. S. W. Lancashire, the Lincoln Warp, Fen district, and

the Central Norfolk Loam are above 300 dollars. About 60 per cent of the income comes from crops.

For Scotland the following sections were included in the high category: the crop-livestock-dairy area of the eastern coastal plain from Berwick to Aberdeen and the dairy section of Ayre and the north shore of the Solway Firth.

The efforts made by Britain to increase its food supply, especially during the war periods, have been highly successful and it is not to be expected that the pattern shown on the map will change substantially in the near future. The areas of relatively low standard of land use generally have soils of low quality. The upland areas are used principally for sheep grazing.

IRELAND

The case of Ireland is a very difficult one (Fig. 7). As the map indicates, no part of the Irish Republic is included in the high category. Some areas came quite close to it, but the value of 44 pounds per acre (300 dollars per ha) was not reached for any larger area. The yields for wheat and barley and the yield of milk per cow have been fairly good (in 1957, 2341 kg). Nevertheless, the gross revenue has not been high. The Central Statistical Office in Dublin published income data in the National Farm Survey 1957–1958 Interim Report, September 1958. It recognizes three regions, namely the East and Midland, the South, and the North and West. The gross revenue is given for five types of farming—all dairy, crop mixed, cattle mixed, subsistence and others—and also takes into consideration the size of the farm. Only in the South do some types of farms of the class 5–15 acres have values above 44 pounds sterling.

The reason for the low value is probably a social one. The Irish farmer does not exert himself. One gets the impression that he could do much better but he lives well on his farm and has enough to eat. Why should he bother to produce more? See, for instance, the high consumption of butter and eggs (Table II). In the so-called "congested" west, incomes are quite low; the average size of the farms is about 15 acres and the income about 17 pounds sterling per acre.

The productive value is probably higher in Northern Ireland and reaches the higher level around Lake Neagh and near Derry. The farmers there are more disciplined; they went through the last war when the food supply had to be increased, and are under more strict government control. However, final details here must await more information.

ICELAND

Land use in Iceland is extensive—only 5.3 per cent of the farm income comes from crops, chiefly potatoes. Cattle prevail in the north and southwest; sheep in the northwest and east. Most of the island is in the third category on the map, indicating physical limitations to land use. However, in summer a great deal of this third-category land is used for grazing.[2]

AGRARIAN PROBLEM OF WESTERN EUROPE

This is not the place to discuss the problem areas of Western Europe but some general remarks can be made as suggestions for further study. The problem areas do not always coincide with the areas of low standard of land

[2] For detailed information the reader is referred to "A Regional Geography of Iceland" by Vincent H. Malmstrom, National Academy of Science, National Research Council Publication 584, April 1958, Washington.

use. It can be said that all areas have their problems, even those with a very high standard. High costs of production and fragmentation are only two of those. At the same time some of the areas of low standard are well adjusted and produce up to the maximum of their possibility. The chief problem area, however, is the one in the Mediterranean part of Europe; southern France; Italy, with the exception of the northern part; Spain; and Portugal. Even in these there are sections of high intensity but these are chiefly irrigated. From a climatic point of view the large problem area coincides with the existence of a relatively dry summer period and with great differences in precipitation between years in contrast to the rather even distribution and dependability of the climate in the countries to the north. Nevertheless, there are many other reasons—historical as well as social—which have hampered progress and which can be somewhat remedied. But the major problem of a European free trade is how to protect those farmers who produce little and yet have to live. It will be costly and uneconomical, but it has to be done as long as those millions cannot be taken up by industrial developments.

Changes in the Agricultural Pattern of Western Europe

Some of the changes which can be expected are the direct result of European cooperation. If not especially financed certain types of crop production in some countries will have to be abandoned as they are quite artificial, based largely on the desire to be less deficient in the national food consumption. A good example of that is Switzerland where most of the crop production will have to be replaced by a livestock economy based on grass and possibly root crops.

But greater changes can be expected as the result of changes in consumption if the standard of life improves. If the per capita consumption of the United States is used as an indication of the trend some conclusions can be reached (see Table II). The consumption of bread grain has somewhat declined since the prewar period. If the Europeans ate as little cereal as the Americans there would be a surplus in Europe instead of a deficit. It is not suggested that this will happen in the near future, especially in southern Europe, but the consumption of cereal will decrease. The same may be true for potatoes. On the other side, there will be an increase in the consumption of meat and milk which will mean greater emphasis on stock raising (dairy and meat cattle). Also, there should be an increase in citrus fruit production which will mean more emphasis on irrigation in southern Europe. Increase of milk consumption will probably mean less emphasis on butter, especially if the quality of margerine improves in some of the now butter-eating nations. With emphasis on horticulture and livestock and deemphasis of bread grains, it seems quite possible that Western Europe, in due time, will become self-sufficient in most of her needs. Perhaps we shall see the time when we have extensive grazing on the Spanish Meseta instead of the low-yielding wheat fields we have today.

MEASUREMENT OF AGRICULTURAL EFFICIENCY IN UTTAR PRADESH

Muhammad Shafi

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AGRICULTURAL efficiency can be determined by several methods. One of them is to measure it in terms of output per unit area, while another is to determine it in terms of output per worker. Still another method is to assess it by the value of agricultural output. The simplest of all the methods of judging the agricultural efficiency, however, consists in the measurement of output per unit area. In a world short of food, what really matters is the actual amount of food produced, and making some allowance for the quality of the production we can say that the higher the output per unit area, the greater is the efficiency of the farmer.

On the basis of the acre-yield statistics of crops, it should be possible to indicate the areas where agriculture, as it exists at present, can be considered as efficient. The efficiency is in the sense that it obtains the maximum return from the soil, the differentials in productivity per unit area being the result partly of natural advantages of soil and climate and partly of farming technique.

Professor M. G. Kendall of the London School of Economics made an approach to this subject, treating it as a mathematical problem, and devised a system of "ranking coefficients," the purpose of which is to arrange in order any given number of countries growing the same range of crops and then assess their agricultural efficiency. Professor L. Dudley Stamp, applying this technique on an international basis, selected a number of countries as well as some major crops, the choice of crops depending upon the fact that each one of them was grown in all of the countries selected. He placed the countries in the order of output per acre for each crop. The places occupied by each country in respect to the selected crops were then averaged and from these averages the ranking coefficient of agricultural efficiency of each country was obtained.[1] As for example, if a country were at the top of every list, it would have a ranking coefficient of one, and if it were at the bottom of every list it would have a ranking coefficient equal to the total number of countries concerned.

As far as the writer is aware, the agricultural efficiency of any part of India has not been assessed by the ranking coefficient method.[2] In the following pages, an attempt has therefore been made to determine the agri-

[1] L. Dudley Stamp: Our Undeveloped World, London, 1953, p. 93.

[2] Dr. S. M. Ali, formerly of the University of Aligarh and at present Professor of Geography at the University of Saugor, initiated a discussion in the Geography and Geodesy Section of the 28th Session of the Indian Science Congress held in 1941 to formulate numerical scale to measure agricultural productivity but no progress was made in this direction.

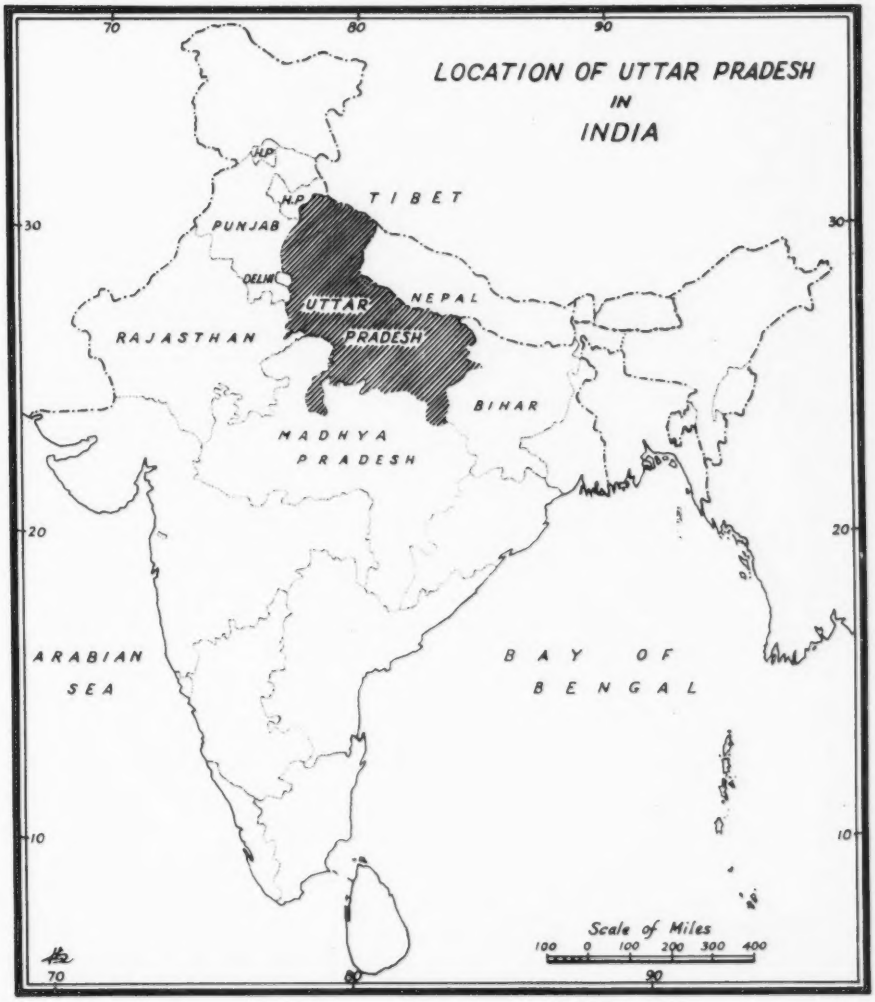

FIG. 1.

cultural efficiency of the districts of Uttar Pradesh, a state which stands fourth in order of area and first in order of population among the states of India, and where three-fourths of the population is engaged in agriculture. However, before assessing the agricultural efficiency of the districts of Uttar Pradesh, it would be worthwhile to examine its general environment.

Uttar Pradesh lies between the latitudes of 23°52′ and 31°18′ N. and the longitudes of 77°3′ and 84°39′ E.[3] In the north its boundary coincides with those of Nepal and Tibet in the Himalayas; on the west and south are the states of Himachal Pradesh, Punjab,

[3] Uttar Pradesh was formerly known as the United Provinces of Agra and Oudh but in January, 1950, it was renamed as the State of Uttar Pradesh.

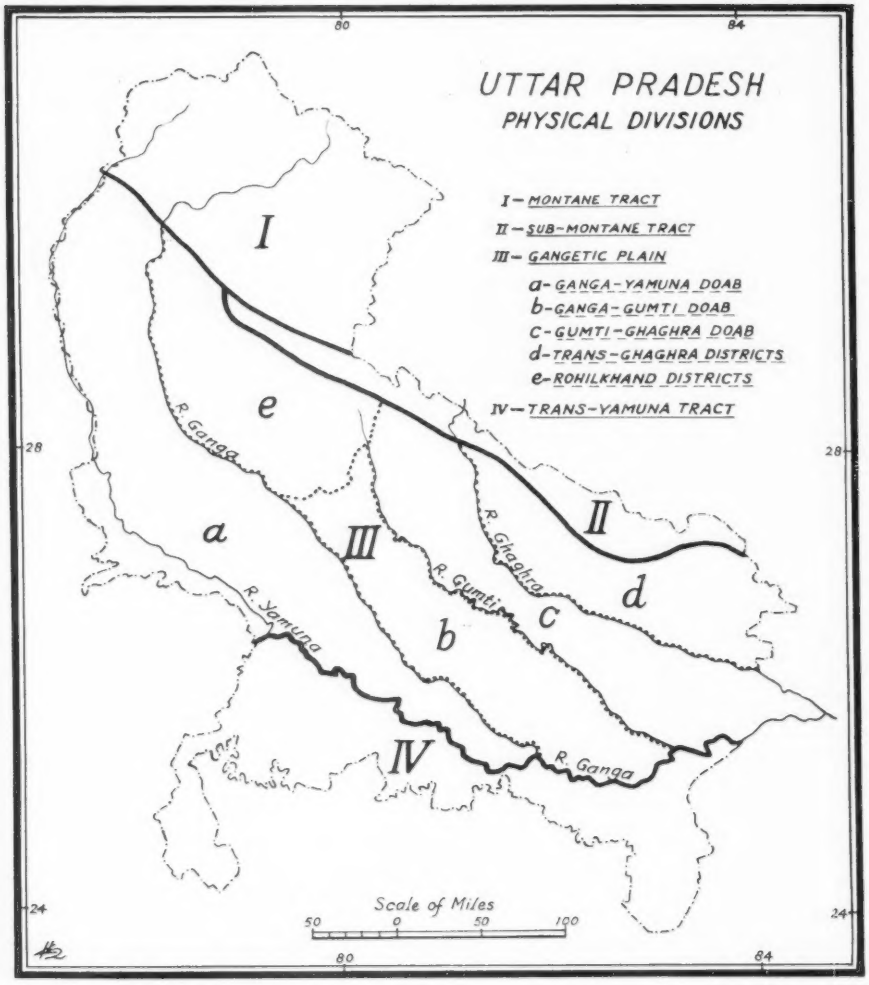

FIG. 2.

Delhi, and Rajasthan; to the south lies the state of Madhya Pradesh and on the east the state of Bihar (Fig. 1).

Uttar Pradesh consists of four broad physical divisions (Fig. 2): (I) the montane tract; (II) the sub-montane tract; (III) the Gangetic plain; and (IV) the trans-Yamuna tract.

I. The districts lying in the montane tract are largely under forest; they are thinly populated and cultivation is found only in scattered areas.

II. The sub-montane tract includes portions of the Tarai and Bhabar. The latter lies immediately below the foothills and is covered by gravel and sand. On entering this region, the hill torrents sink beneath the surface and are lost, but since the Tarai is a damp and marshy tract the streams lost in the

Bhabar reappear. Incidentally it should be mentioned that the Tarai is the most unhealthy region of the state.

III. The Gangetic plain consists of a vast level expanse of alluvium. The Ganga-Yamuna Doab (III-a) is very fertile for its soil is enriched by the alluvial deposits of both the rivers. Agriculture here is relatively secure since the Doab districts are well supplied with canal and tube-well irrigation facilities.

The tract lying between the Ganga and the Gumti (III-b) is less fertile than the Ganga-Yamuna Doab. The reason for this is that the Gumti, which together with its tributaries commands most of the area, is a small river rising from a lake situated in the plain. On account of the very gentle gradient of the plain the river flows in a tortuous course and the area is dotted with numerous small lakes which are mostly seasonal. During the hot weather these lakes dry up, but in the wet monsoon months their waters overflow and inundate the neighboring lands resulting in much waterlogging. The soil fertility is generally low and as far as irrigation facilities are concerned the tract is not so well protected from the vagaries of the monsoon as is the Ganga-Yamuna Doab.

In the Gumti-Ghaghra tract (III-c) the soil deteriorates still further. The Ghaghra brings large quantities of sand so that the districts bordering this river have a higher percentage of sandy soil than is found in the southern districts. Agriculture of the districts in this tract depends largely on rainfall and the vagaries of the monsoon affect the outturn considerably.

The northern parts of the trans-Ghaghra districts (III-d) include portions of the Tarai where the climate is unhealthy and the soil during the wet monsoon months remains waterlogged. However, the soils in the southern parts of these districts are better and yet on the whole they are inferior to those of the Gumti-Ghaghra tract. Irrigation facilities in the trans-Ghaghra tract are inadequate and agricultural operations depend on rainfall. Whenever the rains fail, spring wells constitute the main source of water supply, but these too dry up and cultivation literally becomes a gamble in the monsoon.

The districts which adjoin the montane tract known as Rohilkhand (III-e) derive little benefit from the major rivers of the state, the result being that the soil is not enriched by occasional floods. As far as the climate and vegetation of the northern portions of these districts are concerned, they are similar to those of the Tarai areas.

IV. The trans-Yamuna tract known as Bundelkhand forms part of the Indian Plateau. Here the soil is predominantly of black color and is very retentive of moisture. In seasons of heavy rainfall, it quickly becomes oversaturated and its miry nature makes tillage impossible, but when the rainfall is small it becomes too hard to be turned up by the plow. Mirzapur district occupying the southeastern portion of the state also forms part of this plateau. However, some areas in the north of this district consist of alluvial plains and are thus excluded from the plateau.

Keeping the above-mentioned salient characteristics of the physical divisions of Uttar Pradesh in mind, Table I and II may be examined. These tables show acre-yields of crops in pounds for the 48 districts of this state as well as the positions occupied by these districts in order of yield per acre for each crop for the quinquennials ending in 1952 and 1957.[4] Figure 3 shows the ranking

[4] There are 51 districts in Uttar Pradesh but three of them, all being mountainous, have

(*Continued on page 302*)

TABLE I—COMPARISON OF 48 DISTRICTS OF UTTAR PRADESH IN ACRE-YIELD OF 8 CROPS
(Position indicates the districts numbered in order of yield per acre for each crop)

	Rice		*Wheat*		*Barley*		*Gram*		*Juar*		*Bajra*		*Maize*		*Arhar*		*Total*	*Average (ranking coefficient)*
	Yield per acre	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*		
Dehradun	575	2	530	27	802	13	427	25	446	10	406	16	642	14	1,413	1	108	13.50
Saharanpur	575	2	727	6	802	13	534	14	446	10	406	16	642	14	1,413	1	76	9.50
Muzaffarnagar	575	2	886	2	802	13	617	2	446	10	406	16	642	14	1,417	1	60	7.50
Meerut	575	2	865	3	802	13	496	20	446	10	406	16	752	6	1,413	1	71	8.87
Bulandshahr	575	2	915	1	702	16	427	25	446	10	470	14	745	7	1,413	1	76	9.50
Aligarh	566	3	779	5	848	10	556	10	332	12	539	10	733	9	1,088	3	62	7.75
Mathura	566	3	806	4	1035	1	530	15	332	12	360	16	874	2	1,088	3	56	7.00
Agra	566	3	806	4	943	4	593	5	332	12	565	9	874	2	1,088	3	42	5.25
Mainpuri	566	3	806	4	943	4	556	10	332	12	669	3	874	2	1,088	3	41	5.12
Etah	566	3	680	14	801	14	556	10	332	12	634	5	874	2	1,088	3	63	7.87
Bareilly	424	24	563	25	591	25	460	24	428	11	474	13	724	10	1,046	4	136	17.00
Bijnor	449	19	680	14	591	25	500	18	428	11	474	13	724	10	1,046	4	114	14.25
Moradabad	405	26	583	20	591	25	500	18	428	11	332	17	724	10	1,046	4	131	16.37
Pilibhit	465	17	529	28	591	25	500	18	428	11	474	13	724	10	1,046	4	126	15.75
Budaun	496	12	578	21	591	25	500	18	428	11	534	11	724	10	1,046	4	112	14.00
Shahjahanpur	496	12	572	23	591	25	537	13	428	11	474	13	724	10	1,046	4	111	13.87
Rampur	496	12	529	28	591	25	500	18	428	11	474	13	724	10	1,046	4	121	15.12
Farukhabad	664	1	680	14	876	6	555	11	599	7	600	7	825	3	1,381	2	51	6.37
Etawah	664	1	697	9	876	6	555	11	599	7	845	1	825	3	1,381	2	40	5.00
Kanpur	664	1	697	9	863	8	630	1	695	4	600	7	825	3	1,381	2	35	4.37
Fatehpur	664	1	697	9	685	21	615	3	695	4	600	7	825	3	1,381	2	50	6.25
Allahabad	522	9	697	9	724	19	560	9	599	7	635	4	825	3	1,381	2	62	7.75
Jhansi	554	4	639	17	771	17	502	17	527	8	620	6	791	4	670	8	81	10.12
Jalaun	554	4	671	15	771	17	488	21	448	9	620	6	791	4	670	8	84	10.50
Hamirpur	554	4	634	18	771	17	560	9	616	6	620	6	791	4	670	8	72	9.00
Banda	554	4	577	22	771	17	481	22	762	3	620	6	791	4	670	8	86	10.75
Varanasi	450	18	641	16	791	15	591	6	662	5	727	2	736	8	766	7	77	9.62
Mirzapur	468	15	641	16	529	27	591	6	662	5	727	2	736	8	766	7	86	10.75
Jaunpur	467	16	641	16	980	2	591	6	662	5	727	2	917	1	766	7	55	6.87
Ghazipur	341	29	641	16	873	7	591	6	662	5	727	2	736	8	766	7	80	10.00
Ballia	432	23	641	16	822	12	591	6	662	5	727	2	736	8	766	7	79	9.87
Gorakhpur	529	7	687	12	553	26	474	23	836	2	727	2	633	15	636	9	96	12.00
Deoria	470	14	724	8	640	23	474	23	836	2	727	2	633	15	636	9	96	12.00
Basti	525	8	589	19	520	28	474	23	836	2	727	2	633	15	636	9	106	13.25
Azamgarh	437	22	725	7	946	3	474	23	836	2	727	2	633	15	636	9	83	10.37
Nainital	438	21	570	24	592	24	497	19	446	10	465	15	664	13	1,046	4	130	16.25
Rae Bareli	497	11	682	13	663	22	584	7	880	1	532	12	783	5	921	5	76	9.50
Sitapur	411	25	680	14	699	20	613	4	880	1	532	12	783	5	921	5	86	10.75
Kheri	440	20	532	26	663	22	584	7	880	1	532	12	710	11	921	5	104	13.00
Lucknow	537	6	682	13	663	22	584	7	880	1	532	12	783	5	921	5	71	8.87
Unnao	537	6	682	13	840	11	584	7	880	1	532	12	783	5	921	5	60	7.50
Hardoi	537	6	694	11	883	5	543	12	880	1	532	12	783	5	921	5	57	7.12
Faizabad	525	8	695	10	741	18	514	16	836	2	583	8	543	17	857	6	85	10.62
Gonda	392	27	462	30	741	18	377	26	836	2	583	8	693	12	857	6	129	16.12
Bahraich	385	28	469	29	741	18	514	16	836	2	583	8	587	16	857	6	123	15.37
Sultanpur	544	5	695	10	741	18	514	16	836	2	583	8	543	17	857	6	82	10.25
Pratapgarh	509	10	695	10	854	9	514	16	836	2	583	8	543	17	857	6	78	9.75
Barabanki	495	13	695	10	741	18	578	8	836	2	583	8	543	17	857	6	82	10.25

Source: The acre-yield figures have been taken from the Quinquennial Statement of the average yield of principal crops in Uttar Pradesh (Statistical Section, Department of Agriculture, Uttar Pradesh, Lucknow) for the period 1947–1948 to 1951–1952.

TABLE II—COMPARISON OF 48 DISTRICTS OF UTTAR PRADESH IN ACRE-YIELD OF 8 CROPS

(Position indicates the districts numbered in order of yield per acre for each crop)

	Rice		*Wheat*		*Barley*		*Juar*		*Bajra*		*Maize*		*Gram*		*Arhar*		*Total*	*Average (ranking coefficient)*
	Yield per acre	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*	*Yield per acre*	*Position*		
Dehradun	640	7	600	28	768	15	257	13	311	17	717	9	417	25	1,078	3	117	14.62
Saharanpur	644	6	616	24	768	15	257	13	311	17	717	9	399	26	1,078	3	113	14.12
Muzaffarnagar	624	11	833	5	768	15	257	13	311	17	717	9	532	13	1,078	3	86	10.75
Meerut	620	12	866	4	768	15	257	13	311	17	940	2	507	19	1,078	3	85	10.62
Bulandshahr	626	10	930	2	840	10	257	13	380	15	867	4	417	25	1,078	3	82	10.25
Aligarh	629	8	893	3	830	12	221	14	441	10	829	6	585	9	1,413	2	64	8.00
Mathura	591	16	933	1	1,057	1	221	14	326	16	970	1	620	6	1,413	2	57	7.12
Agra	603	14	933	1	965	2	221	14	487	7	970	1	700	2	1,413	2	43	5.37
Mainpuri	657	5	933	1	965	2	221	14	560	4	970	1	585	9	1,413	2	38	4.75
Etah	626	9	704	12	751	18	221	14	534	6	970	1	585	9	1,413	2	71	8.87
Bareilly	478	27	632	21	564	26	368	12	389	13	724	8	431	24	952	6	137	17.12
Bijnor	435	36	733	11	564	26	368	12	389	13	724	8	452	23	952	6	135	16.87
Budaun	476	28	653	15	564	26	368	12	428	11	724	8	452	23	952	6	129	16.12
Moradabad	388	44	652	16	564	26	368	12	303	18	724	8	452	23	952	6	153	19.12
Shahjahanpur	508	23	540	29	564	26	368	12	389	13	724	8	477	20	952	6	137	17.12
Pilibhit	429	37	625	23	564	26	368	12	389	13	724	8	452	23	952	6	148	18.50
Rampur	436	35	625	23	564	26	368	12	389	13	724	8	452	23	952	6	146	18.25
Farukhabad	678	2	756	9	856	7	424	9	477	8	840	5	516	15	1,627	1	56	7.00
Etawah	680	1	788	6	856	7	424	9	759	2	840	5	516	15	1,627	1	46	5.75
Kanpur	666	4	788	6	895	3	492	7	477	8	840	5	640	4	1,627	1	38	4.75
Fatehpur	676	3	788	6	697	20	634	4	477	8	840	5	639	5	1,627	1	52	6.50
Allahabad	452	33	788	6	870	5	424	9	540	5	840	5	612	7	1,627	1	71	8.87
Jhansi	408	39	631	22	762	16	612	5	467	9	697	10	522	14	703	8	123	15.37
Jalaun	406	40	744	10	762	16	398	10	467	9	697	10	461	21	703	8	124	15.50
Hamirpur	404	41	789	7	762	16	744	2	467	9	697	10	550	12	703	8	105	13.12
Banda	492	26	652	16	762	16	759	1	467	9	697	10	479	19	703	8	105	13.12
Varanasi	460	30	640	19	836	11	456	8	804	1	743	7	552	11	857	7	94	11.75
Mirzapur	512	22	640	19	681	22	456	8	804	1	743	7	552	11	857	7	97	12.12
Jaunpur	455	32	640	19	862	6	456	8	804	1	906	3	552	11	857	7	87	10.87
Ghazipur	398	42	640	19	852	8	456	8	804	1	743	7	552	11	857	7	103	12.87
Billia	440	34	640	19	789	14	456	8	804	1	743	7	552	11	857	7	101	12.62
Gorakhpur	555	19	651	17	556	27	523	6	804	1	496	16	512	17	660	9	112	14.00
Deoria	455	32	603	27	589	25	523	6	804	1	496	16	512	17	660	9	133	16.62
Basti	521	21	688	14	481	28	523	6	804	1	496	16	512	17	660	9	112	14.00
Azamgarh	391	43	690	13	874	4	523	6	804	1	496	16	512	17	660	9	109	13.62
Nainital	552	20	648	18	625	24	384	11	384	14	693	11	513	16	952	6	120	15.00
Lucknow	596	15	636	20	653	23	685	3	412	12	599	12	594	8	983	4	97	12.12
Unnao	620	12	636	20	746	19	685	3	412	12	599	12	594	8	983	4	90	11.25
Rae Bareli	580	18	636	20	653	23	685	3	412	12	599	12	594	8	983	4	100	12.50
Sitapur	459	31	744	10	761	17	685	3	412	12	599	12	704	1	983	4	90	11.25
Hardoi	607	13	704	12	847	9	685	3	412	12	599	12	510	18	983	4	83	10.37
Kheri	460	30	610	25	653	23	685	3	412	12	593	13	594	8	983	4	118	14.75
Faizabad	478	27	774	8	686	21	612	5	644	3	521	15	564	10	962	5	94	11.75
Gonda	496	25	606	26	686	21	612	5	644	3	540	14	458	22	962	5	121	15.12
Bahraich	409	38	509	30	686	21	612	5	644	3	464	17	564	10	962	5	129	16.12
Sultanpur	470	29	774	8	686	21	612	5	644	3	521	15	564	10	962	5	96	12.00
Pratapgarh	504	24	774	8	798	13	612	5	644	3	521	15	564	10	962	5	83	10.37
Barabanki	590	17	774	8	686	21	612	5	644	3	521	15	688	3	962	5	77	9.62

Source: The acre-yield figures have been taken from the Quinquennial Statement of the average yield of principal crops in Uttar Pradesh (Statistical Section, Department of Agriculture, Uttar Pradesh, Lucknow) for the period 1951–1952 to 1956–1957.

FIG. 3.

coefficients of these districts for the years 1952–1957. In Table III the districts have been placed in order of their agricultural efficiency. It will be seen from this table that agriculture is most efficient, that is to say, the production of food per cultivated acre is highest in the districts of Ganga-Yamuna Doab where the soil, in general, is more fertile than in the rest of the state and where agriculture is more secure on account of canal and tube-well irrigation. The table further shows that the districts of Kanpur, Mainpuri, Etawah, Agra, Farukhabad,

been omitted. Only eight crops where selected because for other crops statistics of yield per acre based on estimates by sampling for the quinquennials ending in 1952 and 1957 were not available. These statistics are published by the Statistical Section of the Department of Agriculture, Uttar Pradesh.

TABLE III

FORTY-EIGHT DISTRICTS OF UTTAR PRADESH IN ORDER OF AGRICULTURAL EFFICIENCY

1947-1952			1952-1957		
Districts	*Ranking coefficient*	*Ranking position*	*Districts*	*Ranking coefficient*	*Ranking position*
1. Kanpur	4.37	1	Kanpur	4.75	1
2. Etawah	5.00	2	Mainpuri	4.75	1
3. Mainpuri	5.12	3	Agra	5.37	2
4. Agra	5.25	4	Etawah	5.75	3
5. Fatehpur	6.25	5	Fatehpur	6.50	4
6. Farrukhabad	6.37	6	Farrukhabad	7.00	5
7. Jaunpur	6.87	7	Mathura	7.12	6
8. Mathura	7.00	8	Aligarh	8.87	7
9. Hardoi	7.12	9	Etah	8.88	8
10. Muzaffarnagar	7.50	10	Allahabad	8.88	8
11. Unnao	7.50	10	Barabanki	9.62	9
12. Aligarh	7.75	11	Bulandshahr	10.25	10
13. Allahabad	7.75	11	Hardoi	10.37	11
14. Etah	7.87	12	Pratapgarh	10.37	11
15. Meerut	8.87	13	Meerut	10.62	12
16. Lucknow	8.87	13	Muzaffarnagar	10.75	13
17. Hamirpur	9.00	14	Jaunpur	10.87	14
18. Bulandshahr	9.50	15	Unnao	11.25	15
19. Rae Bareli	9.50	15	Sitapur	11.25	15
20. Saharanpur	9.50	15	Varanasi	11.75	16
21. Varanasi	9.62	16	Fyzabad	11.75	16
22. Partapgarh	9.75	17	Sultanpur	12.00	17
23. Ballia	9.87	18	Mirzapur	12.12	18
24. Ghazipur	10.00	19	Lucknow	12.12	18
25. Jhansi	10.12	20	Rae Bareli	12.50	19
26. Sultanpur	10.25	21	Ballia	12.62	20
27. Barabanki	10.25	21	Ghazipur	12.87	21
28. Azamgarh	10.37	22	Hamirpur	13.12	22
29. Jalaun	10.50	23	Banda	13.12	22
30. Fyzabad	10.62	24	Azamgarh	13.62	23
31. Banda	10.75	25	Gorakhpur	14.00	24
32. Mirzapur	10.75	25	Basti	14.00	24
33. Sitapur	10.75	25	Saharanpur	14.12	25
34. Gorakhpur	12.00	26	Dehradun	14.62	26
35. Deoria	12.00	26	Kheri	14.75	27
36. Kheri	13.00	27	Nainital	15.00	28
37. Basti	13.25	28	Gonda	15.12	29
38. Dehradun	13.50	29	Jhansi	15.37	30
39. Shahjahanpur	13.87	30	Jalaun	15.50	31
40. Budaun	14.00	31	Budaun	16.12	32
41. Bijnor	14.25	32	Bahraich	16.12	32
42. Rampur	15.12	33	Deoria	16.62	33
43. Bahraich	15.37	34	Bijnor	16.87	34
44. Pilibhit	15.75	35	Bareilly	17.12	35
45. Gonda	16.12	36	Shajahanpur	17.12	35
46. Nainital	16.25	37	Rampur	18.25	36
47. Moradabad	16.37	38	Pilibhit	18.50	37
48. Bareilly	17.00	39	Moradabad	19.12	38

and Fatehpur, all lying in the central and lower parts of the Ganga-Yamuna Doab, have a higher agricultural efficiency than the districts of upper Doab. Towards the north of the Doab as well as towards the south, agricultural efficiency decreases gradually. With the help of ranking coefficient values, the districts can be given ranking positions in agricultural efficiency as is indicated in Table III. With certain minor adjustments, these ranking positions can be arranged into five groups (Table IV and Fig. 4).

From the foregoing classification of the districts it will be seen that the Ganga-Yamuna Doab districts have the efficiency of the highest grade while the Rohilkhand districts stand lowest in the scale and the remaining districts possess agricultural efficiency of a medium grade.

Kanpur occupies the highest position among the districts. If the existing

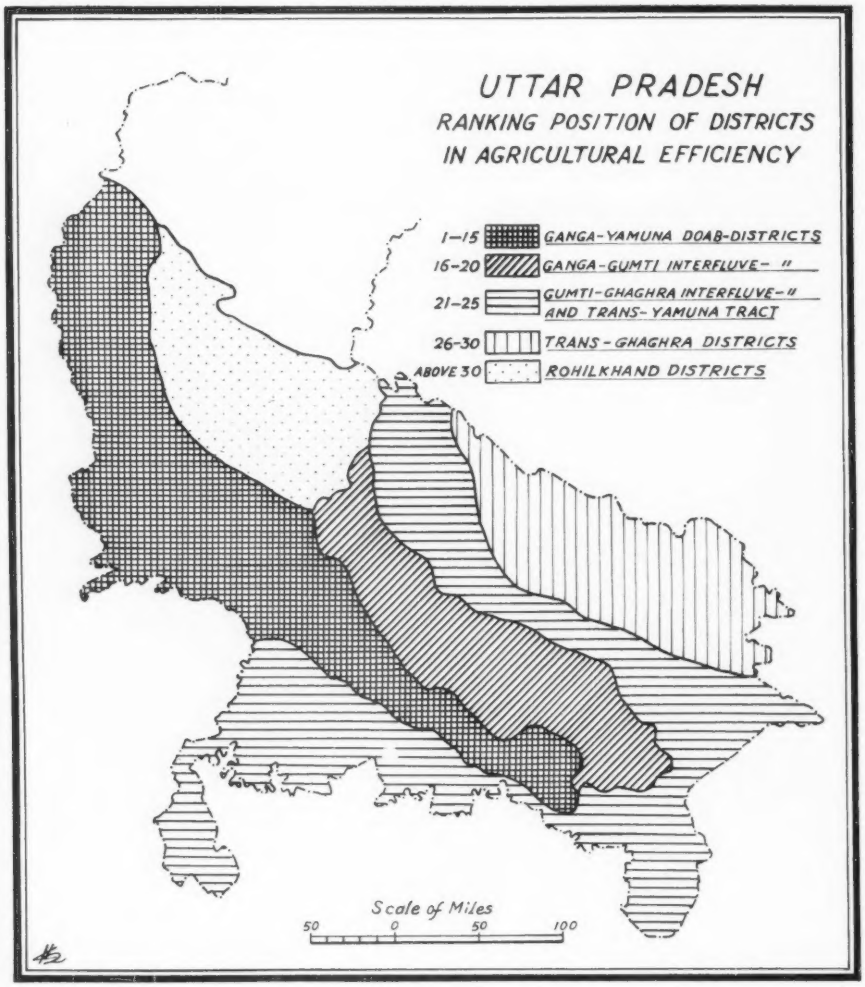

FIG. 4.

agricultural efficiency of Kanpur, as shown by Table III, is taken as the desirable standard, it will be seen that the agricultural efficiency of the trans-Ghaghra is only one-third of that of Kanpur while that of the Rohilkhand districts is only one-fourth.

The low position of the latter districts may be explained by the fact that their northern portions, with the exception of Budaun, adjoin the sub-montane tract of the Himalayas and are similar in vegetation and climate to the Tarai region. It is the infertility of the soil and the unhealthiness of the climate which is largely responsible for the low level of agricultural efficiency in the districts.

This brief assessment of the agricultural efficiency of Uttar Pradesh reveals

TABLE IV

DISTRICTS GROUPED IN ORDER OF AGRICULTURAL EFFICIENCY

Districts	*Ranking positions in agricultural efficiency*
I. Ganga-Yamuna Doab districts[1]	1–15
II. Ganga-Gumti Interfluve districts[2]	16–20
III. Gumti-Ghaghra Interfluve districts and trans-Yamuna tract	21–25
IV. Trans-Ghaghra districts	26–30
V. Rohilkhand districts	Above 30

[1] Parts of the districts of Agra and Mathura lie outside the Doab, but since the acre-yield figures relate to the districts as a whole the parts outside may be included in the doab.

[2] The Gumti flows through the northern portions of some districts which are included in the Doab, but, as the acre-yield figures have been considered on a district basis, entire districts may be included in the Doab.

that despite hard work the farmer is getting a rather small return in most of the districts, particularly in those of the trans-Ghaghra and Rohilkhand. This opens up a further line of investigation and perhaps indicates the need of focusing attention on the weaker parts where, with the provision of improved seeds and fertilizers and with due attention to better tillage practices, to a balanced rotation of crops, and to an adequate and assured agricultural water supply, the level of agricultural efficiency could be considerably increased. If only the agricultural efficiency of the other districts of Uttar Pradesh is brought to the level of that of the central and lower Doab districts, the food production of the state will be substantially augmented and this will help in the solution of the food problem of not only Uttar Pradesh but of India as a whole.

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DISTRIBUTION AND SIGNIFICANCE OF THE FOREIGN TRADE PORTS OF NORWAY

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SINCE early history the Norwegians have been a maritime minded people. Rugged topography combined with meager natural resources forced many of the people to look to the sea for food and economic opportunity. Most of them settled on the limited areas of relatively level land adjacent to the coast with access to productive agricultural land, forests, water power, and the sea. Fishing, whaling, industrial, and commercial activities developed in numerous excellent protected harbors scattered along the extensive fjorded and island dotted coast. Oslo and Bergen dominate Norway's ports but many smaller coastal centers have grown up serving limited hinterland areas. A number of minor ports, especially those found interior on the fjords, are engaged in local passenger and freight trade. Trade with foreign nations is limited to sixty custom stations found in the larger ports except for the four which are in railway stations near the Swedish border (Fig. 1). The objective of this paper is to analyze the distribution and significance of the foreign trade ports of Norway. These coastal trade centers are the principal focal points of economic production and distribution and are major indicators of the nature of the regional economic geography of Norway.

Role of Norway in World Trade

Norway occupies a somewhat peripheral position in relation to the main oceanic trade routes of the North Atlantic. Her many ports, however, have direct access to the Barents Sea, Norwegian Sea, North Sea, and Skaggerak.

Foreign trade connections with the rest of the world are dominantly by water transportation. Western Europe and the United States are dominant areas with which Norway trades and over 50 per cent of the total value of trade is normally with four countries: the United Kingdom, West Germany, Sweden, and the United States. Mining and metal products; fish and fish products (including whale oil); and wood products comprise nearly four-fifths of the exports; and manufactured products, food, and fuel make up 80 per cent of the imports. Recent industrialization has increased Norway's dependence upon foreign trade for diverse materials. The value of Norwegian foreign trade, averaging $573 per capita, ranked fifth in Europe and eighth in the world in 1956.[1] If the income from merchant shipping is added Norway leads all other nations.

Earnings from 9 million gross tons of merchant shipping, fourth largest in the world, normally cover about

[1] *Statistisk Aarbok for Norge*, Statistisk Sentralbyraa, Oslo, 1958, p. 350.

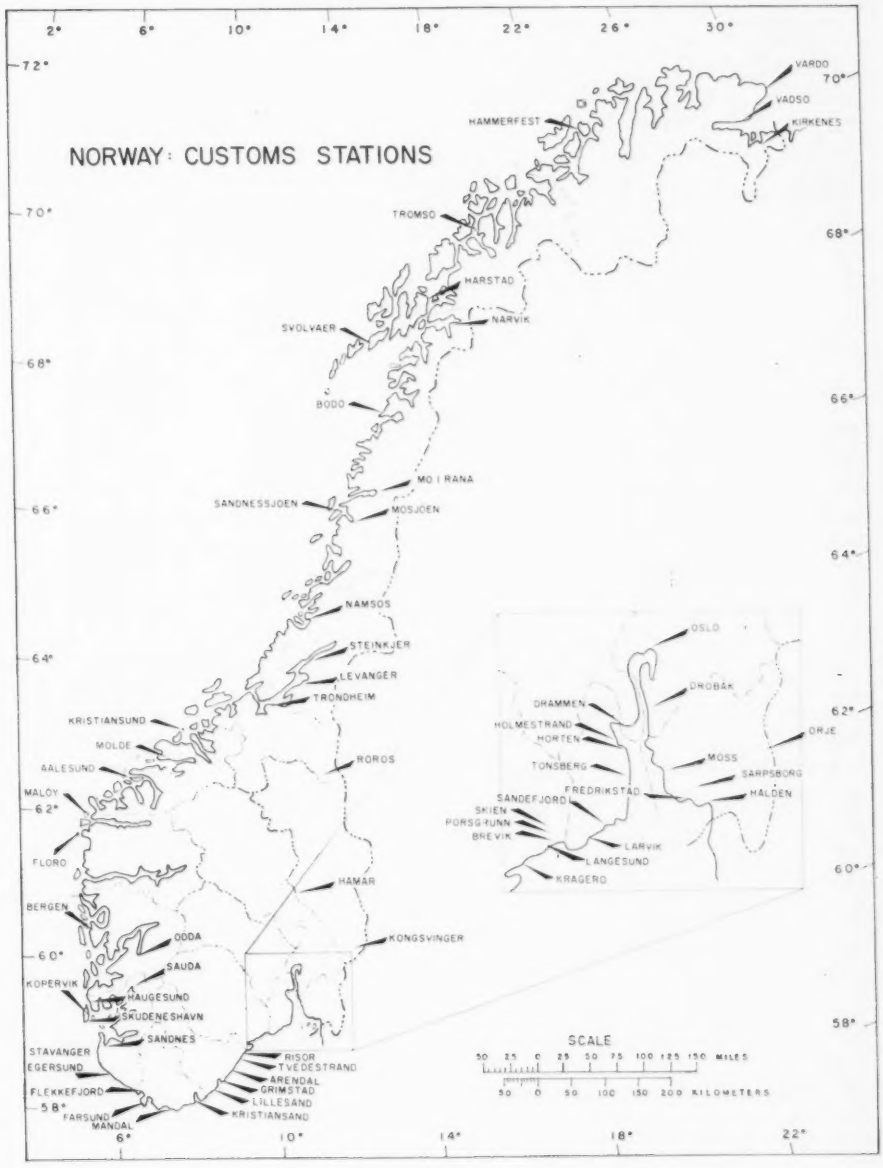

FIG. 1.

one third of Norway's imports; an extremely important factor in maintaining a balance of trade. The Norwegian merchant marine has connections with almost every port in the world but emphasis is with western Europe and eastern United States. Of the total tonnage, about 90 per cent is

involved in transporting goods between foreign ports, 5 per cent in coastal trade, and 5 per cent in whaling and fishing. In addition other vessels from all parts of the world help to move goods in and out of Norway's ports.

NORWAY'S FOREIGN TRADE PORTS[2]

Except for the small amounts of foreign trade which enter and leave the country by rail and air, the overwhelming proportion depends upon sea transportation. Only a little over one per cent of the value of Norway's foreign trade is registered in the inland custom stations along the Swedish border. Coastal ports are the principal collection and dispersion centers for goods destined for both the domestic and foreign markets. Domestic production and markets are concentrated near the coast with easy access to water transportation (Fig. 2). Land transportation is well developed only in southeast Norway.

The predominant share of foreign trade thus focuses upon the 56 customs stations scattered in ports along the coast. For ease of discussion these ports will be divided into three groups: (1) those on the south from Flekkefjord to Halden, (2) the west from Egersund to Steinkjer on Trondheim Fjord, and (3) the north from Namsos to Kirkenes (Fig. 1).

The 26 ports of the south handled 64 per cent of the value of Norway's total foreign trade in 1955. Oslo, the chief port, contributed one-third of all foreign trade and 51 per cent of the trade of the southern region; Kristiansand, Drammen, and Porsgrunn combined provided another 21 per cent.[3] The ports of this area tap the best agricultural and forest resources of Norway as well as the major market

[2] Statistical material for this section, including data for all the maps was taken from "Norges Handel 1955, Del I & II," Statistisk Sentralbyraa, Oslo, 1957.

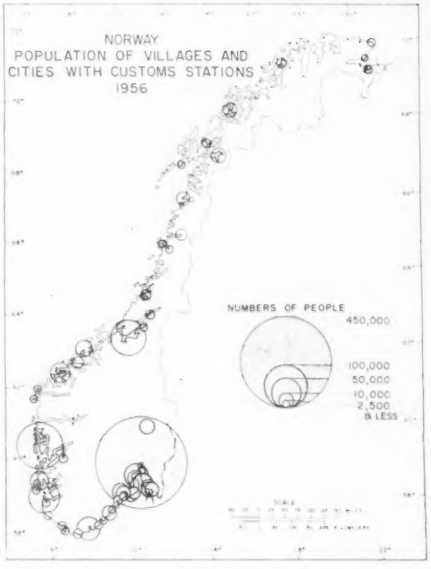

FIG. 2.

of the industrial and population core in southeast Norway.

The 17 west coast ports contributed 31.2 per cent of the value of Norway's foreign trade. Bergen alone accounts for 36 per cent of the trade of this area and Stavanger and Trondheim 14 per cent each. Many of these ports, located on islands or near the mouths of fjords, serve a relatively small hinterland of coastal and fjord population. Only Stavanger, Sandnes, and Egersund in the south, Bergen in the center, and Trondheim, Levanger, and Steinkjer in the north have railway connections with Oslo and the southeast. All west coast ports have easy access to the rich offshore fishing banks and fish and fish products dominate the exports in 8 of the 17.

[3] For a detailed analysis of the port traffic of the Oslofjord region, your attention is called to the following recent study: T. Ouren, *The Port Traffic of the Oslofjord Region*, Norwegian School of Economics and Business Administration, Geographical Series #6, Bergen, 1958, 168 pages, maps.

The 13 foreign trade ports of northern Norway are more widely spread and accounted for a little less than 4 per cent of the total trade. No one port dominates as do Oslo and Bergen in the other two coastal districts. Narvik would appear much more important but the northern Sweden iron ore exported via this port is in transit and thus does not appear in the Norwegian statistics. The total population in this area is relatively small and the hinterland of each port is limited in area, resources and markets.

Export Ports

The ports of Norway from Trondheim Fjord south completely dominated the value of exports with 94 per cent of the total. Three concentrations of export ports appear in the southern half of Norway (Fig. 3). The southeast section from Kristiansand to Oslo is by far the most important with its exports of forest products, including pulp and paper, electrometallurgical and diverse manufactured products. A second cluster is the Bergen to Stavanger group specializing in fish, ships, and electrometallurgicals. A third group includes the fish processing cities of Kristiansund and Aalesund and diversified Trondheim.

A little over one-half or 21 of the ports of Norway have fish and fish products (including whaling products) as dominant exports (Fig. 4). Most of these are located along the west and north coasts with Bergen, Aalesund, Kristiansund, and Stavanger contributing 64 per cent of the total value of exports of fish and fish products. All of the western ports process fresh, frozen, dried, and canned fish from raw materials originating locally as well as from the fishing banks of northern Norway, Iceland, western Greenland, and other North Atlantic grounds.

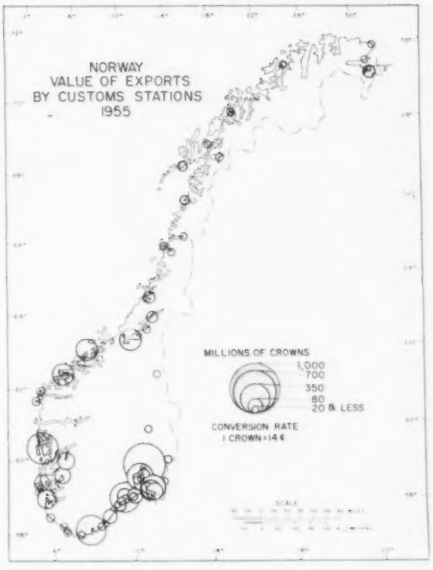

FIG. 3.

Sandefjord on the south coast is the principal home port of Norwegian whaling fleet and is the chief whale oil exporting center.

Exports of forest and paper products dominate 16 of Norway's 56 foreign trade ports. All but three are located along the southeast and south coasts where rivers have transported the timber cut on the southeast flanks of the highlands to ports at or near their mouths. Levanger, Steinkjer, and Namsos along with Trondheim are the major outlets for the forest products obtained from the slopes bordering the Trondheim depression. The chief exporting centers in this category are Drammen, Oslo, Sarpsborg, and Halden which together contribute 64 per cent of the total value. The higher valued paper products increase the importance of such ports as Drammen, Skien, and Brevik. Paper products, the leading single export product from Oslo, pro-

TABLE I

MAJOR EXPORT PORTS OF NORWAY, 1955*

Port	Value Nor. crowns	Percentage of total
Oslo	642,835	14.0
Bergen	455,361	10.1
Porsgrunn	358,313	7.9
Kristiansand	352,552	7.8
Sarpsborg	253,840	5.6
Drammen	248,567	5.5
Aalesund	185,850	4.1
Trondheim	176,918	3.9
Kristiansund	164,037	3.6
Stavanger	142,952	3.2
Others	1,532,071	34.3
Total	4,513,296	100.0

Norges Handel 1955, Del II, Statistisk Sentralbyraa, Oslo, 1957, pp. 208–219.

vide one-fourth of the total value leaving by ship.

Manufactured products, other than those from fish and the forests, are leading exports from 12 ports. Oslo with its diversified manufacturing of paper products, ships, hides and skins, pulp, metals, and chemicals among others is by far the most important single port in this category. The others are scattered along the coast with specialization in electrometallurgicals at Moss, Kristiansand, Sauda, Odda, and Bodö; shipbuilding at Tonsberg and Sandnes; fertilizer and chemicals at Porsgrunn and Arendal; machines and textiles at Mandal; and iron and steel at Mo i Rana. These ports take advantage of accessible cheap hydroelectric power and the inexpensive water transportation for import of raw materials in the development of their respective industries.

Products of the mines lead the exports in six ports widely distributed along the coast. Kirkenes, with iron ore, and Trondheim, with pyrites, iron ore, and other minerals are the two leading exporters in this category. Others are very minor with the exception of Narvik which exports primarily Swedish iron ore.

Agriculture is almost exclusively for domestic consumption, and only negligible amounts enter foreign trade channels. Fredrickstad, the only port with agricultural exports dominant, ships plant and animal fat which is processed here.

Import Ports

Nearly 98 per cent of the value of imports entered ports of west and southern Norway in 1955 (Fig. 5). Oslo alone accounted for 43 per cent of the import trade. Two concentrations of import centers exist. The Kristiansand to Oslo and Stavanger to Bergen groups are the same as in the case of exports. All other ports north of Bergen except Trondheim are of relatively small importance.

Diversified manufactured materials, Norway's predominant import category, are the chief commodities imported by three-fourths of the ports. Most of these are concentrated on the south

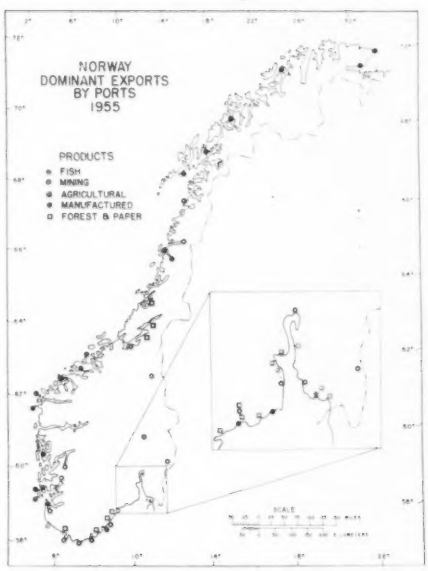

FIG. 4.

coast but others are scattered on the west and north coast as well.

Agricultural products are the second major type of import but rank first in only four ports, three in the south and one in the north. All others import agricultural products in various quantities.

Minerals, including base metals and raw materials for fertilizer manufacturing, and fuels, primarily coal and petroleum, are the leading imports in only nine ports. Coal and petroleum are important products brought into most of the custom stations but dominant in only a few of the small fishing and petroleum refining centers.

POSTWAR TRENDS IN THE ECONOMY AND FOREIGN TRADE OF NORWAY

The changing emphasis in Norway's economy is reflected by materials funneled in and out of the foreign trade ports. Norway, especially in the post-World War II period, has increased industrialization so that manufacturing is the leading segment of the economy. More raw materials and semi-manufactured products are being imported by Norway's enterprises and her own raw materials are being processed, often into finished goods, before export. This adds considerably to the value of the export products, and helps to offset the unfavorable balance of trade.

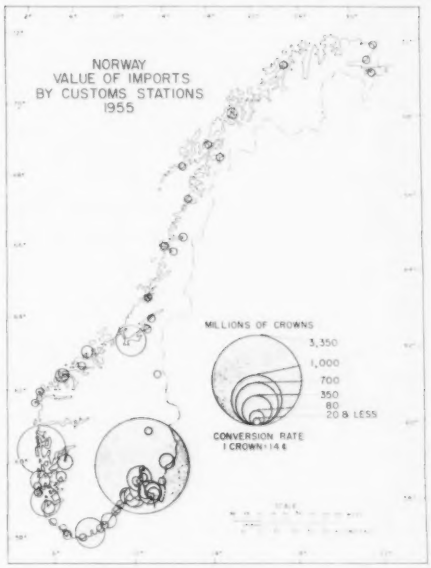

FIG. 5.

TABLE II

MAJOR IMPORT PORTS OF NORWAY, 1955*

Port	*Value Nor. crowns*	*Percentage of total*
Oslo	3,350,097	43.1
Bergen	923,155	11.9
Stavanger	399,035	5.1
Trondheim	364,437	4.7
Kristiansand	348,496	4.5
Drammen	235,589	3.0
Fredrikstad	216,240	2.8
Tonsberg	158,728	2.0
Sandefjord	156,864	2.0
Hangesund	153,513	2.0
Others	1,476,437	18.9
Total	7,782,591	100.0

Norges Handel 1955, Del. II, Statistisk Sentralbyraa Oslo, 1957, pp. 208–219.

Norway is extremely dependent upon foreign trade and especially the water transportation contacts with the rest of the world. The major part of her commercial, industrial, and agricultural development is coastal oriented. The ports are the focal centers of economic activity, particularly Oslo and Bergen, which together have 44 per cent of the total trade of the country.

Export trade is more evenly divided among the ports than imports. Raw materials such as fish and timber are generally processed on the coast near the production areas while the widely distributed hydroelectric power facilitates other industrial growth in many places along the coast. Concerted post-World War II attempts have been made to increase the economic base of northern Norway such as exemplified by the new iron and steel

center at Mo i Rana but the population and economic development remains concentrated primarily in southeastern Norway and secondarily along the west coast as far north as Trondheim. Imports are even more centered in southeastern Norway, especially Oslo.

This analysis emphasizes the role of Norway's ports as foci of Norway's transportation system and economic development. The south coast with Oslo as the center emerges as the economic core of the country, the west coast as the secondary economic region, and the northern coast as minor in importance. As the population grows, the concentrations of economic development are likely to be strengthened. The economic future of Norway appears firmly tied to the coast and the many excellent foreign trade ports.

ACKNOWLEDGMENTS

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INTRAURBAN VARIATION OF RESIDENTIAL QUALITY

Roland J. Fuchs

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RESIDENTIAL quality is not uniform within cities. Instead, the dwelling units within a city vary from place to place in this respect. While urban students and even casual observers are aware of this, little study has been made of the degree of variation of residential quality in particular cities and how the range differs from city to city.

The problem can be studied at various levels; for example, one could study variation of quality of the dwelling units as found in a unit such as a block. At another level one could examine the manner in which blocks or neighborhoods of differing quality are intermingled in a city. Then again, one might be concerned simply with a gross measure of variation for a city as a whole, taking into account each individual dwelling unit but ignoring the internal distinction by blocks or neighborhood units.

It is this last approach which has been followed. Specifically, the study had as its purposes: (1) to measure the relative degree of intraurban variation of residential quality for a large number of cities; (2) to examine the nature of differences in this characteristic, especially areally; and (3) to search for possible associations between this characteristic and other urban phenomena.

Measuring Variation of Residential Quality

The initial step was to devise a method of measuring the relative degree of intraurban variation of residential quality. Actually, this required two separate decisions. First, it was necessary to select some criterion to approximate residential quality, since quality itself is not directly measurable; second, a suitable statistical measure had to be chosen to measure the degree of relative variation.

Finding an indicator of residential quality proved difficult. While a number of special measures of residential quality have been devised for previous studies, none appeared suitable for use in this study.[1] Designed for other purposes, these measures failed to provide a means of conveniently obtaining quality ratings for the individual dwellings in each of a large number of cities.

Finally chosen as the most satisfactory available indicator of residential quality, despite some rather obvious defects, was rental or housing cost.[2]

[1] See, for example, Homer Hoyt: *Structure and Growth of Residential Neighborhoods in American Cities*, Federal Housing Authority, Washington, 1939; Robert C. Klove: "A Technique for Delimiting Chicago's Blighted Areas," *Journ. of Land and Publ. Util. Econs.*, Vol. 17, 1941, pp. 483–484; Donald L. Foley: "An Index of Housing in Chicago," *Journ. of Land and Publ. Util. Econs.*, Vol. 18, 1942, pp. 209–213; American Public Health Association: *An Appraisal Method for Measuring the Quality of Housing: A Yardstick for Health Officials and Planners*, 3 parts, New York, 1945–1950; Philip Dauling: "A Short-cut Method for Evaluating Housing Quality," *Land Econs*, Vol. 25, 1949, pp. 184–192; Telesforo W. Luna, Jr.: *Delimitation of High Quality Residential Land Use in Worcester, Massachusetts*, unpublished Ph.D. dissertation, Clark University, 1957.

[2] The deficiencies of rent as an indicator of residential quality are discussed by Leon Pollard: "Technique for Determining Relative Housing

(*Continued on next page*)

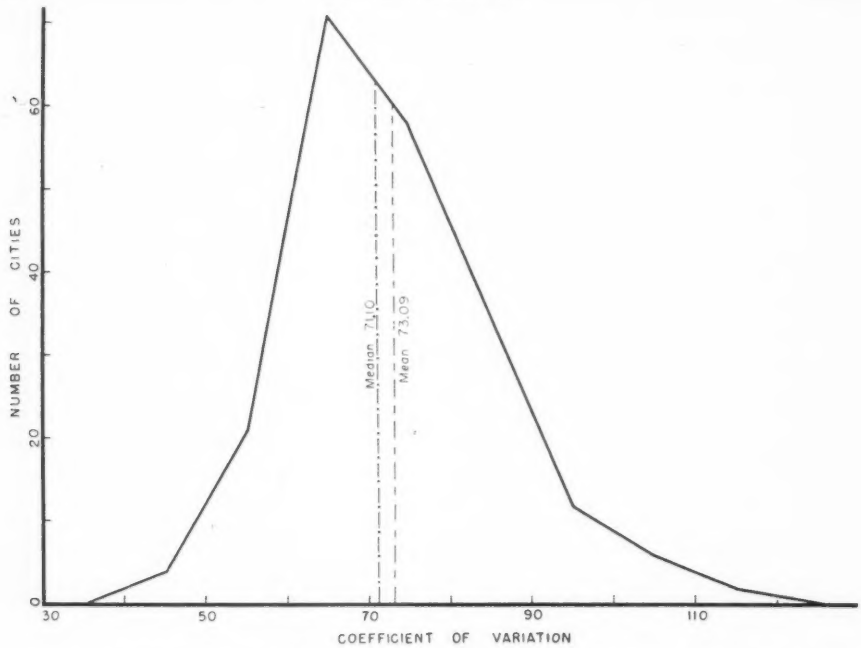

FIG. 1. Distribution of the coefficients of variation. The 209 study cities are shown as a group.

Housing cost as represented by the contract monthly rent was directly available for renter- or tenant-occupied dwelling units from the 1950 Census of Housing.[3]

For owner-occupied dwelling units the procedure was somewhat more involved. Typically, the great majority of owner-occupied dwelling units are in the form of one-dwelling-unit structures. The Census Bureau, while it does not furnish estimated rental costs for such units, does provide "value"; this represents an estimate of what "the property including the structure and its land would sell for under ordinary conditions and not at forced sale." The estimated sale price can be converted to an estimated rental figure by employing a real estate rule: "There is a close relationship between rents being paid and the price for which the property will sell. It is often stated as a general rule of thumb that a property is worth one hundred times the monthly rent or that, it should rent for one percent of the cost of the property."[4]

By employing this conversion method, one can obtain rental equivalents for the great majority of owner-occupied dwelling units. A portion remains un-

Quality," *Journ. of Amer. Inst. of Planners*, Vol. 19, 1953, pp. 49–57. However, Hoyt concluded that rent alone was significantly representative of a host of other housing factors to use as a basis of analysis. See Hoyt, *op. cit.*, especially Chapter 4, "An Alternative Technique in the Analysis of Residential Areas."

[3] U. S. Bureau of the Census: *U. S. Census of Housing: 1950*, Vol. I, *General Characteristics*, Washington, D. C., 1953. See, especially, Table 21.

[4] Leevern Johnson: "The Appraisal of Homes," *Appraisal Journ.*, Vol. 24, 1956, p. 516. This conversion rate places the yearly rental rate at 12 per cent of the cost. Some appraisers place the proper rate at 9 per cent or at a figure between 9 and 12 per cent. For this study 12 per cent has been chosen because it seems to be most commonly employed and also permits the most convenient conversion when employing census categories.

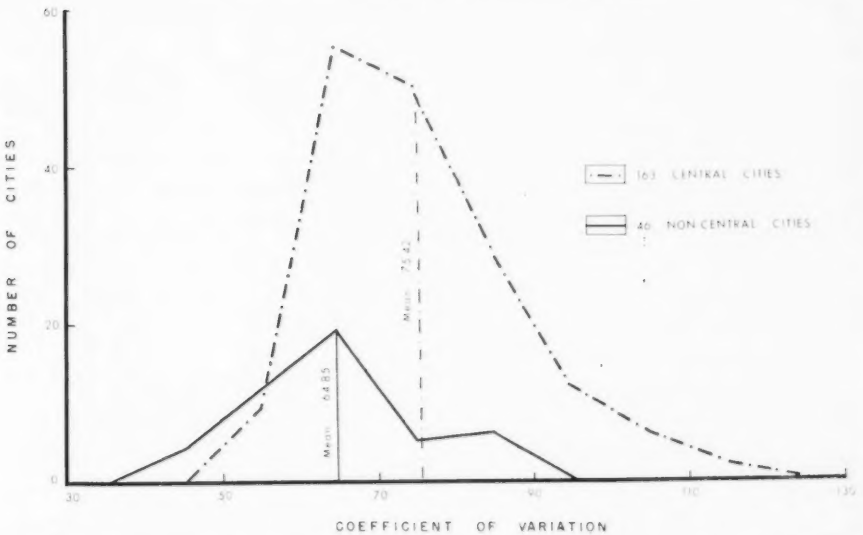

FIG. 2. Distribution of the coefficients of variation for central and noncentral cities. The central cities are significantly more varied than the noncentral cities.

accounted for. It is composed of owner-occupied dwelling units in other than one-dwelling-unit structures, that is, those in multiple-unit structures. The extent of this deficiency varies from city to city, but it appears that typically about 90 per cent of all occupied, reported dwelling units have a rental equivalent included under the above methods. While the absence of 10 per cent of the dwelling units should not be minimized as a defect, it should also be noted that the missing owner-occupied dwelling units in multiple-dwelling-unit structures are ones least likely to have either extremely low or high rental equivalents and therefore unlikely to have much effect on a measure of variation.

A Statistical Measure of Variation

The standard deviation is now the most widely used of all measures of dispersion or variation. It is generally recommended, unless there be reason to the contrary, that this measure be used to describe dispersion. However, the standard deviation is an *absolute* measure of dispersion. It is not valid to compare the standard deviation of two groups unless their means are approximately the same. In the current study, cities with widely differing mean rental costs are to be compared and so a *relative* measure of variation is called for.

There is available a simple modification of the standard deviation which makes it a relative measure and permits it to be used comparatively. This involves dividing the standard deviation by the mean of the series and multiplying the quotient by 100 to put the result in percentage form. This yields the well-known coefficient of variation.[5]

One difficulty remained before the coefficients of variation could be computed for the study cities. This resulted

[5] Climatologists have used this measure in studying variation in precipitation. See Preston E. James and Clarence F. Jones, Edits.: *American Geography: Inventory and Prospect*, Syracuse, 1954, p. 351.

from the Census Bureau's use of "open end" categories. Specifically the Census has as its final category for contract monthly rent "$100 or more" and as the uppermost category for the value of one-dwelling-unit structures "$20,000 or more." Such open end categories cannot be employed, as they stand, in computing the coefficient of variation. It is necessary to assume or somehow arrive at midpoints for these categories to make computation possible.

The author devised a method for reapportioning the dwelling units in these "open end" categories into "closed end" subcategories with definite midpoints. In this method the affected dwelling units were assigned to subgroups in the same proportion that blocks, weighted by the number of dwelling units, with average rents or rental equivalents in those subgroups were found in the city concerned. This reapportionment method is based upon data found in the *Block Housing Statistics* published subsequent to the 1950 Census of Housing.[6] Of necessity, the group of cities studied was limited to the 209 for which block statistics were published. Each of these cities had a population of 50,000 or more prior to 1950.

The Coefficients of Variation of Housing Costs

The next step was to compute coefficients of variation for each of the study cities on the basis of the housing costs of the individual dwelling units within the city. It was assumed that the resulting coefficients indicated the degree of relative variation in residential quality within these cities. The greater the numerical value of the coefficient, the greater the relative variation indicated.

Individual coefficients of variation ranged from the 44 per cent of Burbank, California, the least varied city, to the 118 per cent of Charleston, South Carolina, the most varied city. This is a considerable range and warrants the conclusion that cities differ markedly in the degree of variation of residential quality with some much more varied than others.

When arranged in a frequency polygon, the 209 coefficients of variation take on the shape of a more or less normal, I-shaped curve (Fig. 1). The mean is approximately 73 per cent, and the median is about 71 per cent. This indicates that the series is somewhat skewed to the right with more extreme values above the median than below it. This is evident when the scores are grouped into class intervals (Table I).

TABLE I

DISTRIBUTION OF 209 UNITED STATES CITIES BY COEFFICIENT OF VARIATION OF HOUSING COSTS

Coefficient of variation	*Number of cities*
40– 50	4
50– 60	21
60– 70	71
70– 80	58
80– 90	35
90–100	12
100–110	6
110–120	2

Central and Noncentral Cities

While computing and compiling the coefficients of variation, the suspicion grew that two different groups of cities were being considered. One group was composed of cities which were clearly subordinate to nearby larger cities and seemed to have consistently lower coefficients than did a second group made up of the dominant cities themselves. In order to determine if any significant difference actually existed, it was neces-

[6] U. S. Bureau of the Census: *U. S. Census of Housing: 1950*, Vol. II, *Block Housing Statistics*, Washington, D. C., 1951.

sary to select some consistent basis upon which the cities could be divided. For expediency, the study group was divided according to Census definition into central and noncentral cities, and summarizing measures were computed for each group.[7] The results are shown in Table II and graphically in Figure 2.

TABLE II

CENTRAL AND NONCENTRAL CITIES—COEFFICIENTS OF VARIATION

Central cities		*Noncentral cities*
163	Number	46
54.0–117.5	Range of C.V.	43.6–89.8
75.4	Mean C.V.	64.9
71.1	Median C.V.	62.1

When the coefficients of variation for the 163 central cities are compared with those of the 46 noncentral cities, a general difference becomes apparent. Noncentral cities have lower coefficients as a group. The mean coefficient of variation is less than 65 per cent for noncentral cities but more than 75 per cent for central cities. Statistical testing revealed that the difference between the means is a significant one and that it is unlikely that it could have occurred by chance.[8] It would seem safe to conclude that noncentral cities are generally less varied and more uniform in residential quality than central cities.

Because of this basic difference, the inspection of areal differences and the correlation analysis which follow are confined to the 163 central cities. The central city and noncentral city dichotomy is re-examined at a later stage of the paper.

Areal Differences in the Coefficients of Variation

Of particular interest is the nature of the areal differences in intraurban variation of residential quality. In Figure 3, the coefficients of variation have been

[7] For definition of a central city see U. S. Bureau of the Census, *U. S. Census of Housing: 1950*, Vol. I, *op. cit.*, p. xv.

[8] Used to test the significance of the difference between the two means was the "t" test at the .01 level of significance.

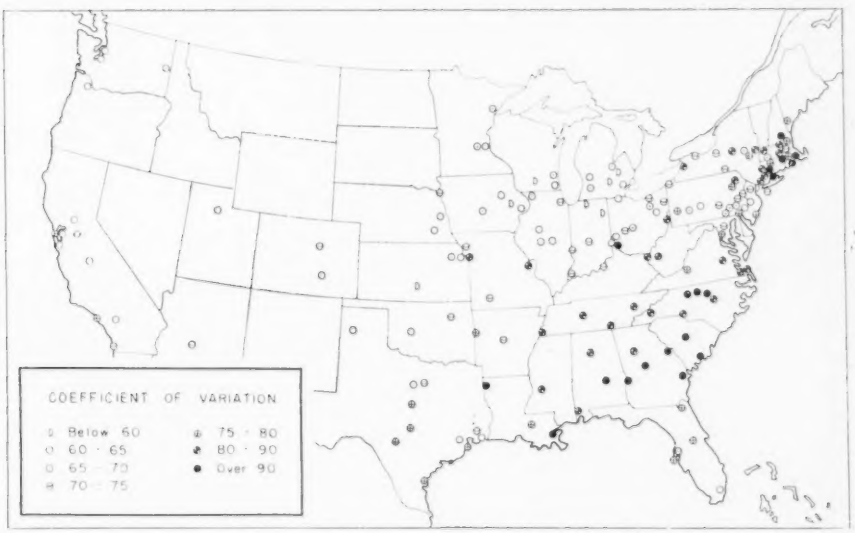

FIG. 3. Coefficients of variation of 163 central cities.

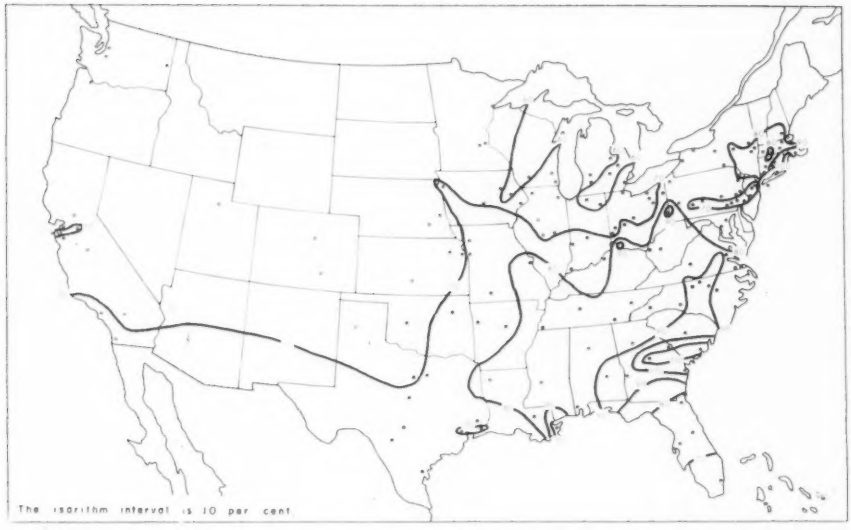

FIG. 4. Isarithm patterns of the coefficients of variation. Based on the central cities only.

mapped for each of the 163 central cities.

Even a casual survey reveals that there exists some order, a regularity of pattern. Values are not haphazardly intermixed, but instead demonstrate regional similarities. The highest coefficients, and presumably the greatest degrees of variation of residential quality, occur in the cities of the Southeast and New England with a wedge of lower values between. The Southeast area of high coefficients is much more extensive than that of New England. The lowest coefficients of variation are found in the vicinity of the Great Lakes and in the West. The Florida peninsula has notably lower coefficients than does the adjacent Southeast.

To examine the transition of the degrees of variation, an isarithm map was constructed employing an interval of 10 per cent (Fig. 4). The steepest gradients occur generally in connection with the two areas of high coefficients of variation. Gradients are very steep around central Georgia and southern South Carolina in ascent to the two cities with the greatest variation: Charleston, South Carolina, and Macon, Georgia. Similar steep gradients are found approaching Fall River, Massachusetts, and Providence, Rhode Island, the New England cities most varied in residential quality.

Central Illinois, Indiana, and Ohio is another area of rapid change in the coefficients of variation. To the north are the lowest coefficients of all, and transition is abrupt to the higher values of both the Southeast and New England. Rapid change is particularly noticeable between Cincinnati and Hamilton, Ohio, and between Wheeling, West Virginia, and Canton, Ohio.

To simplify these results, a map presenting generalized regions of intra-urban variation of housing costs was constructed (Fig. 5). Three categories were employed with boundary limits of the intermediate category set at one-half standard deviation above and below the central city mean coefficient of variation. All but 15 cities conformed to the regional criteria.

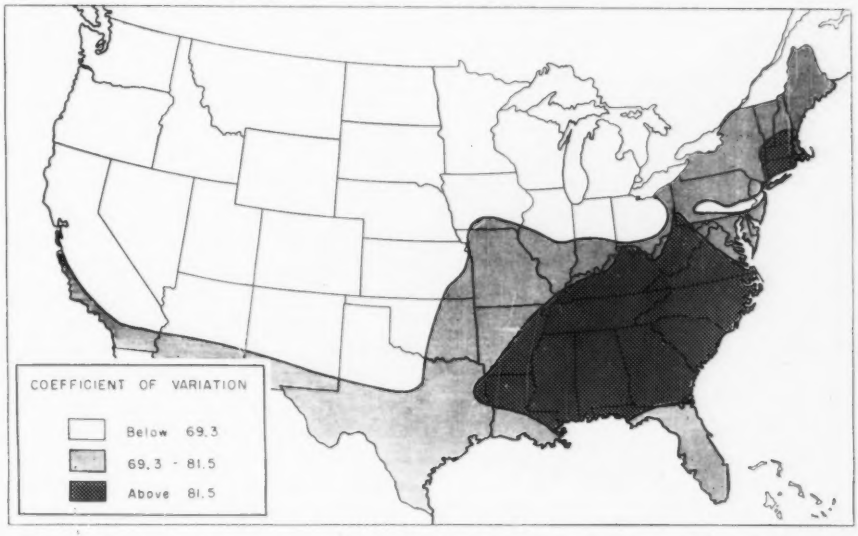

FIG. 5. Regions of intraurban variation of residential quality. Regions of low, moderate, and high degrees of variation have been delimited using the coefficients of variation of the central cities only.

Admittedly a gross simplification, this map retains the most prominent features of the previous maps. Emphasized are the areas where variation is the greatest: New England and the more extensive section of the Southeast. Also prominent is the large West, North, and North-Central region with the lowest coefficients of variation and a trough of similar low readings in southern Pennsylvania and central New Jersey. The "belt" of intermediate readings separating the regions of low and high coefficients of variation is narrowest in southern Illinois, Indiana, and Ohio indicating the rapid transition there.

ASSOCIATION WITH OTHER URBAN CHARACTERISTICS

From the initial portion of the study it was concluded that cities differ substantially in their relative degrees of internal variation of residential quality and that such differences formed patterns of regional similarity. The next step was to determine if the differences in the coefficients of variation were associated with differences in other urban phenomena. For this purpose a variety of urban population, social, and economic characteristics were tested for possible association with the coefficients of variation by variance and correlation analysis.[9]

Variance analysis ruled out significant association in the case of several nonquantitative and quantitative characteristics. Simple correlation was applied

[9] The Pearson Product Moment Coefficient of Correlation has won wide respect and use in the social sciences. For examples of recent application in geographic research see Harold H. McCarty, John C. Hook, and Duane S. Knos: *The Measurement of Association in Industrial Geography*, Department of Geography, University of Iowa, Iowa City, 1956; and George W. Hartman and John C. Hook: "Substandard Urban Housing in United States: A Quantitative Analysis," *Econ. Geog.*, Vol. 32, 1956, pp. 95–114. Both works, but especially the latter, have been used as procedural models for this paper.

Variance analysis provides a means of testing for significant association between a quantitative and nonquantitative characteristic by permitting one to discover if "levels of incidence of a quantitative characteristic differ significantly for the several categories of a nonquantitative characteristic."

to test for association for a larger group of quantitative characteristics. Of these, many yielded a coefficient of correlation above the least significant value at the .05 level of significance (.1597) and so can be considered significantly associated. They are listed in Table III.

Among the urban characteristics which seemed most highly associated with the coefficients of variation were certain income and housing characteristics. The percentage of families with less than $2000 income showed a moderately high, direct association; that is, the greater the proportion of low-income families in the city, the more varied in residential quality it was likely to be. Surprisingly, the percentage of families with less than $2000 income was considerably more associated with the coefficient of variation than was a measure of the variation of income in the city.[10]

[10] It was not possible to use the coefficient of variation to measure variation of income; therefore the measures of variation of income and variation of residential quality are not completely comparable. Relative variation of income was measured by the 10–90 percentile range divided by the median income with the result put in percentage form.

One might logically have expected the variation in income within each city to be very highly associated with variation in residential quality, especially as the latter was measured in terms of housing costs, but this does not seem to be the case.

Another urban characteristic significantly associated with the coefficients of variation was the percentage of dwelling units owner-occupied. The association was moderate and negative which meant that typically the greater the percentage of dwelling units owner-occupied, the less varied was the city in residential quality.

The association between the coefficients of variation and the various urban characteristics, as discussed above, was measured by simple or total correlation. Each coefficient of correlation describes the association between the dependent variable, the coefficient of variation, and but one independent variable. While moderately high association exists in the case of several independent variables, no one alone "accounts for" or statistically "ex-

TABLE III

SIGNIFICANT COEFFICIENTS OF TOTAL CORRELATION AND DETERMINATION BETWEEN COEFFICIENTS OF VARIATION AND SELECTED INDEPENDENT VARIABLES

Independent variable	*Coefficient of correlation (R)*	*Coefficient of determination (R^2)*	*Source of data for independent variable*
Per cent of families with less than $2000 income	.7067	.4994	1
Per cent of dwelling units owner-occupied	−.6313	.3986	4
Per cent of variation of income	.6207	.3852	6
Per cent of dwelling units substandard	.6008	.3610	7
Per cent of population nonwhite or foreign born	.5769	.3329	7
Per cent of dwelling units occupied by nonwhite households	.5559	.3091	4
Dollars of mean housing costs	.5417	.2935	5
Per cent of dwelling units in one-dwelling-unit detached structures	−.2377	.0565	2

Sources of data for independent variable:

1. U. S. Bureau of the Census, *County and City Data Book 1952*, Washington, D. C., 1953, Table 4, Item #221.
2. *Ibid.*, Table 4, Item #251.
3. Computed from data in *ibid.*, Table 4, Item #253.
4. U. S. Bureau of the Census, *U. S. Census of Housing: 1950*, Vol. V, "Block Statistics," Washington, D. C., 1951, Table 1.
5. Computed from *ibid.*
6. For method of computation see footnote 11. Data from U. S. Bureau of the Census, *U. S. Census of Population: 1950*, Vol. II, "Characteristics of the Population," Washington, D. C., 1952, Table 37.
7. Computed from *ibid.*, Table 34, and U. S. Bureau of the Census, *County and City Data Book: 1952*, Table 4, Item #204.

plains" more than 50 per cent of the variation in the coefficients of variation. Apparently, as in most social science problems, it is impossible to arrive at a satisfactory explanation in terms of but one factor. In statistical methodology the techniques of multiple correlation and regression have been developed to determine the association between a dependent variable and two or more independent variables considered simultaneously. Theoretically, there is no limit to the number of independent variables which can be added for consideration, but each addition greatly increases the difficulty of computation.

A number of coefficients of multiple correlation were obtained for various combinations of two or three independent variables. The most efficient equation would appear to be one which considers simultaneously as independent variables the percentage of dwelling units owner-occupied and the percentage of families with less than $2000 income. The average relationship between the coefficients of variation, on one hand, and the combined results of these two independent variables on the other, is summarized by the multiple regression equation:

$$Xc1{\cdot}23 = 81.32 + .8175\,X2 - .4792\,X3$$

Where $Xc1{\cdot}23$ = estimated value of coefficient of variation
$X2$ = per cent of families with less than $2000 income
$X3$ = per cent of dwelling units owner-occupied

This equation is able to account for some 67 per cent of the variation in the coefficients of variation. When various third independent variables are added for consideration, a slight improvement is effected in the multiple correlation coefficient (Table IV); but in no case is the increase large enough to justify the added difficulty of computation.

Admittedly it is difficult to visualize the average relationship between the coefficients of variation and the combined results of the independent variables as expressed in the multiple regression equation. So that these conclusions can be more clearly understood, a table has been prepared showing how the coefficients of variation change under different income and owner-occupancy conditions (Table V).

It is of interest to compare the actual coefficients of variation with the estimated coefficients obtained by applying the multiple regression equation to the income and owner-occupancy data for each city. It has already been shown, of course, that a fairly high degree of accuracy will be obtained. On the chance, however, that such a comparison might give further insight into the effectiveness of the multiple regression equation, a scatter diagram was constructed with the estimated coefficients of variation plotted against the actual coefficients (Fig. 6). Evidently there

TABLE IV

COEFFICIENTS OF MULTIPLE CORRELATION AND DETERMINATION BETWEEN COEFFICIENTS OF VARIATION AND VARIOUS COMBINATIONS OF INDEPENDENT VARIABLES

Independent variables	*Coefficient of multiple correlation* (R)	*Coefficient of determination* (R^2)
Per cent of families with less than $2,000 income Per cent of dwelling units owner-occupied	.8275	.6782
Per cent of families with less than $2000 income Per cent of dwelling units owner-occupied Per cent of dwelling units in structures built before 1919	.8289	.6871
Per cent of families with less than $2000 income Per cent of dwelling units owner-occupied Per cent of dwelling units in one-dwelling-unit detached structure	.8267	.6834
Per cent of families with less than $2000 income Per cent of dwelling units owner-occupied Per cent of dwelling units occupied by nonwhites	.8242	.6793

TABLE V

ESTIMATED* COEFFICIENT OF VARIATION WITH VARYING CONDITIONS OF INCOME AND OWNER OCCUPANCY

Per cent of families with less than $2000 income	*Percentage of dwelling units owner-occupied*					
	70	*60*	*50*	*40*	*30*	*20*
10	54.7	59.7	64.6	69.6	74.6	79.6
20	62.9	67.8	72.8	77.8	82.8	87.7
30	71.0	76.0	81.0	86.0	90.9	95.9
40	79.2	84.2	89.2	94.1	99.1	104.1
50	87.4	92.4	97.3	102.3	107.3	112.3

*Estimated from the multiple regression formula equation:

$$Xc1{\cdot}23 = 81.32 + .8175\ X2 - .4972\ X3$$

Where $Xc1{\cdot}23$ = estimated coefficient of variation
X2 = percentage of families with less than $2000 income
X3 = percentage of dwelling units owner-occupied
R = .8235 R^2 = .6782
S.E. = 7.40

is a general tendency for cities with high actual coefficients to be underestimated by the equation and for cities of low coefficients to be overestimated.

The difference between the actual and estimated coefficients of the central cities has been mapped to examine the effectiveness of the equation as an areal basis (Fig. 7). The West and Northwest is an area of little deviation; here income and owner occupancy conditions can be used to estimate the degree of variation quite well. The situation is not as good in the East and Southeast. An arc of underestimated cities curves from Wheeling, West Virginia, through the Southeast to Montgomery, Alabama. Moderately and severely overestimated cities are clustered in peninsula Florida and in the New York City–Northeastern New Jersey Standard Metropolitan Area. New England presents a mixed pattern of over- and underestimated cities. There is reason to believe that correlation analysis by region might lead to more effective formulas.

CENTRAL VERSUS NONCENTRAL CITIES REVISITED

Perhaps this is a suitable point to reopen the central versus noncentral city question. Is it possible that the low variation of residential quality of noncentral cities can be "explained" in terms of the multiple regression equation developed for central cities? On reflection it appears to be a definite possibility, for many of the noncentral cities are characterized by a small percentage of low-income families and a high proportion of owner-occupied dwelling units—the very combination which would yield low coefficients of variation when substituted in the multiple regression equation.

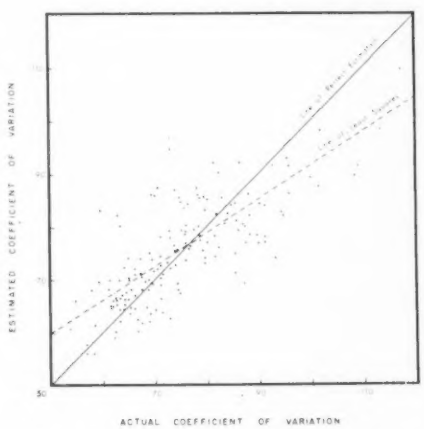

FIG. 6. Comparison of the coefficients of variation as estimated from the multiple regression equation and the actual values for the 163 central cities. Low values tend to be overestimated while high values are underestimated.

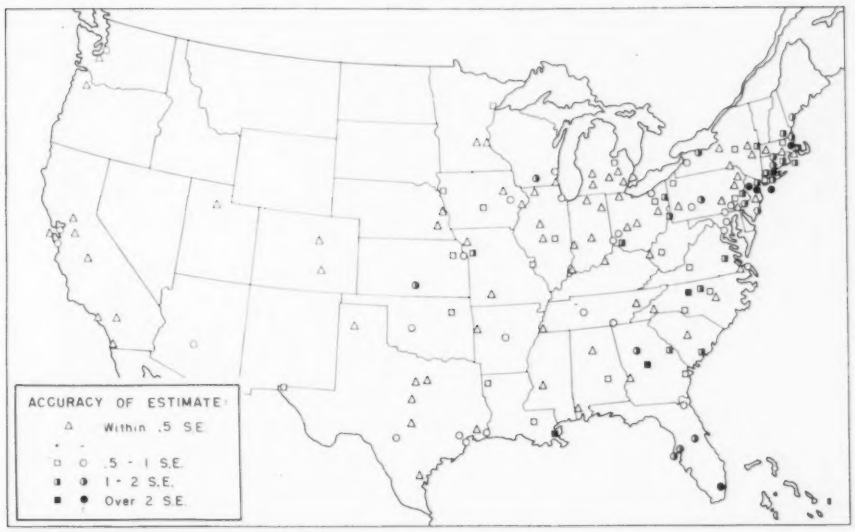

FIG. 7. An accuracy of estimate map. Reference is to the estimating equation $Xc1{\cdot}23 = 81.32 + .8175\ X2 - .4972\ X3$. Shown is the deviation of the actual coefficient of variation from the value (Xc1·23) estimated on the basis of the percentage of families with less than $2,000 income (X2) and percentage of dwelling units owner-occupied (X3). The standard error (S.E.) is 7.4.

To test the possibility that the low coefficients of variation of noncentral cities are consistent with the multiple regression equation developed for central cities, the estimated coefficients were computed for each of the noncentral cities, employing that equation, and then correlated with the actual coefficients. The resulting degree of correlation was only moderate; the coefficient of correlation (r) was but .4881, and the coefficient of determination (r^2) only .2382. The lack of much correspondence between the actual and estimated scores is shown in a scatter diagram (Fig. 8).

In short, not only are noncentral cities less varied in residential quality than central cities, but also this lesser variation cannot be statistically "explained" very successfully by the multiple regression equation developed for central cities. Obviously a multiple regression equation must be developed specifically for noncentral cities, perhaps taking into account factors not important in central cities but operating in noncentral cities to produce less variation in residential quality.

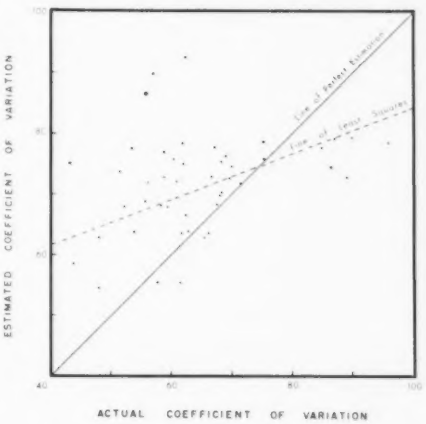

FIG. 8. Comparison of the coefficients of variation as estimated from the multiple regression equation and the actual values for the 46 noncentral cities. The estimating equation is less effective than it is for the central cities (see Figure 6).

TABLE VI

COEFFICIENTS OF VARIATION OF HOUSING COSTS

CENTRAL CITIES

Rank	City	Coefficient of variation (%)	Rank	City	Coefficient of variation (%)	Rank	City	Coefficient of variation (%)
1	Cedar Rapids, Iowa	54.0	56	Peoria, Ill.	69.0	110	Pittsburgh, Pa.	78.9
2	Madison, Wis.	55.3	57	Fort Worth, Tex.	69.1	111	Jacksonville, Fla.	79.5
3	Flint, Mich.	57.1	58	Des Moines, Iowa	69.1	112	Los Angeles, Calif.	79.5
4	Lansing, Mich.	57.3						
5	Wichita, Kan.	57.3	59	Decatur, Ill.	69.4	113	Galveston, Tex.	79.8
6	South Bend, Ind.	58.7	60	Houston, Tex.	69.5	114	Baton Rouge, La.	79.9
7	Fort Wayne, Ind.	58.9	61	Springfield, Ill.	69.6	115	Buffalo, N. Y.	80.0
8	Jersey City, N. J.	59.7	62	Newark, N. J.	70.0	116	Birmingham, Ala.	80.1
9	Rochester, N. Y.	59.7	63	Cleveland, Ohio	70.0	117	Huntington, W. Va.	80.4
10	Dayton, Ohio	61.6	64	Dallas, Tex.	70.0	118	Norfolk, Va.	80.5
11	Detroit, Mich.	61.7	65	Sioux City, Iowa	70.2	119	Scranton, Pa.	80.6
12	Philadelphia, Pa.	61.9	66	Boston, Mass.	70.3	120	Nashville, Tenn.	81.9
13	Fresno, Calif.	62.0	67	Evansville, Ind.	70.7	121	Kansas City, Mo.	81.9
14	Hamilton, Ohio	62.3	68	Syracuse, N. Y.	71.1	122	Worcester, Mass.	81.9
15	San Jose, Calif.	62.3	69	New York, N. Y.	71.1	123	Utica, N. Y.	82.4
16	Waterloo, Iowa	62.6	70	Indianapolis, Ind.	71.2	124	Knoxville, Tenn.	82.6
17	Port Arthur, Tex.	62.6	71	Phoenix, Ariz.	71.3	125	Atlanta, Ga.	82.9
18	Seattle, Wash.	62.8	72	Allentown, Pa.	71.3	126	Portsmouth, Va.	83.1
19	Kansas City, Kan.	62.8	73	Harrisburg, Pa.	71.3	127	Asheville, N. C.	83.7
20	Racine, Wis.	62.8	74	Baltimore, Md.	71.4	128	Raleigh, N. C.	84.1
21	Davenport, Iowa	63.0	75	Stockton, Calif.	71.4	129	Memphis, Tenn.	85.0
22	Miami, Fla.	63.1	76	Denver, Colo.	71.6	130	Waterbury, Conn.	85.5
23	Tacoma, Wash.	63.1	77	Bethlehem, Pa.	71.6	131	Stamford, Conn.	85.6
24	Canton, Ohio	63.5	78	Springfield, Ohio	71.8	132	Mobile, Ala.	85.8
25	Grand Rapids, Mich.	63.6	79	San Diego, Calif.	72.8	133	Lowell, Mass.	85.9
26	San Bernardino, Calif.	63.6	80	Youngstown, Ohio	73.0	134	Jackson, Miss.	86.1
27	Toledo, Ohio	63.7	81	Little Rock, Ark.	73.1	135	Chattanooga, Tenn.	86.9
28	Portland, Ore.	64.0	82	Terra Haute, Ind.	73.1	136	Charlotte, N. C.	87.1
29	Trenton, N. J.	64.4	83	Chicago, Ill.	73.3	137	Bridgeport, Conn.	87.2
30	Salt Lake City, Utah	64.4	84	Beaumont, Tex.	74.2	138	St. Louis, Mo.	87.4
31	Amarillo, Tex.	64.5	85	Binghamton, N. Y.	74.3	139	Troy, N. Y.	87.8
32	St. Paul, Minn.	64.6	86	Tampa, Fla.	74.4	140	Holyoke, Mass.	88.2
33	Altoona, Pa.	64.6	87	Springfield, Mo.	74.5	141	Charlestown, W. Va.	88.3
34	Lincoln, Nebr.	64.9	88	Erie, Pa.	74.6	142	El Paso, Tex.	88.4
35	Sacramento, Calif.	64.9	89	Tulsa, Okla.	74.7	143	Richmond, Va.	88.4
36	Omaha, Nebr.	65.1	90	St. Joseph, Mo.	74.8	144	Greensboro, N. C.	90.1
37	Springfield, Mass.	65.3	91	Roanoke, Va.	75.0	145	Shreveport, La.	90.2
38	Milwaukee, Wis.	65.4	92	Orlando, Fla.	75.2	146	Durham, N. C.	91.2
39	Spokane, Wash.	65.4	93	St. Petersburg, Fla.	75.4	147	Wheeling, W. Va.	91.4
40	Rockford, Ill.	65.5	94	Washington, D. C.	75.5	148	Manchester, N. H.	91.4
41	Lancaster, Pa.	65.6	95	Portland, Me.	76.0	149	Columbia, S. C.	93.0
42	Kalamazoo, Mich.	65.7	96	Austin, Tex.	76.1	150	New Britain, Conn.	93.3
43	Pueblo, Colo.	66.5	97	Wilmington, Del.	76.1	151	Cincinnati, Ohio	94.6
44	Minneapolis, Minn.	66.7	98	Wilkes-Barre, Pa.	76.2	152	New Haven, Conn.	94.9
45	Oklahoma City, Okla.	66.7	99	Louisville, Ky.	76.2	153	Columbus, Ga.	95.7
46	Oakland, Calif.	66.7	100	San Antonio, Tex.	76.3	154	New Bedford, Mass.	96.0
47	Akron, Ohio	66.9	101	Hartford, Conn.	76.6	155	Montgomery, Ala.	96.0
48	Topeka, Kan.	67.0	102	Fort Smith, Ark.	77.0	156	Fall River, Mass.	100.1
49	Saginaw, Mich.	67.6	103	San Francisco, Calif.	77.0	157	Providence, R. I.	101.8
50	Johnstown, Pa.	67.6	104	Corpus Christi, Tex.	78.0	158	Savannah, Ga.	102.2
51	York, Pa.	67.7	105	Lawrence, Mass.	78.6	159	Augusta, Ga.	107.4
52	Columbus, Ohio	67.8	106	Waco, Tex.	78.7	160	Winston-Salem, N. C.	108.5
53	Reading, Pa.	67.8	107	Brockton, Mass.	78.8	161	New Orleans, La.	109.1
54	Schenectady, N. Y.	68.4	108	Atlantic City, N. J.	78.8	162	Macon, Ga.	113.6
55	Duluth, Minn.	68.6	109	Albany, N. Y.	78.8	163	Charleston, S. C.	117.5

NONCENTRAL CITIES

1	Burbank, Calif.	43.6	17	Long Beach, Calif.	60.4	32	Evanston, Ill.	68.0
2	Cleveland Hts., Ohio	47.9	18	Malden, Mass.	60.8	33	Lynn, Mass.	68.0
3	Alhambra, Calif.	48.0	19	Newton, Mass.	61.4	34	Bayonne, N. J.	69.0
4	Dearborn, Mich.	49.7	20	Oak Park, Ill.	61.8	35	East Chicago, Ill.	69.9
5	Highland Park, Mich.	51.5	21	East Orange, N. J.	61.9	36	Alameda, Calif.	70.1
6	Camden, N. J.	52.2	22	Covington, Ky.	62.1	37	Pasadena, Calif.	71.5
7	Somerville, Mass.	53.6	23	Hoboken, N. J.	62.1	38	East St. Louis, Ill.	75.2
8	Pontiac, Mich.	53.8	24	Gary, Ind.	62.3	39	Elizabeth, N. J.	75.3
9	Hammond, Ind.	55.5	25	Medford, Mass.	62.7	40	Mt. Vernon, N. Y.	79.6
10	Union City, N. J.	55.9	26	Cicero, Ill.	65.3	41	Cambridge, Mass.	82.4
11	Irvington, N. J.	56.1	27	Lakewood, Ohio	66.1	42	Pawtucket, R. I.	84.7
12	Quincy, Mass.	57.8	28	McKeesport, Pa.	66.7	43	Yonkers, N. Y.	86.4
13	Glendale, Calif.	58.4	29	Santa Monica, Calif.	67.2	44	Paterson, N. J.	86.9
14	Chester, Pa.	58.9	30	Niagara Falls, N. Y.	67.6	45	New Rochelle, N. Y.	88.9
15	Richmond, Calif.	58.9	31	Berkeley, Calif.	67.8	46	Passaic, N. J.	89.8
16	Muskegon, Mich.	59.4						

SUMMARY AND CONCLUSIONS

Intraurban variation of residential quality has been studied for 209 United States cities (Table VI). Residential quality was measured by housing cost as represented by the monthly rent for tenant-occupied dwelling units and a rental equivalent for owner-occupied dwelling units. The coefficient of variation was chosen as a statistical measure of the degree of variation. Coefficients of variation were then computed for each of the study cities on the basis of housing costs of the individual dwelling units within the city.

The major findings may be summarized as follows:

1. Cities differ in the degree of intraurban variation of residential quality; some show almost three times as much relative variation as do others.
2. Mapping of the central city coefficients reveals an orderly, areal pattern with cities of the Southeast and New England the most varied and cities of the West, North, and Great Lakes area the least varied.
3. By correlation analysis the central city coefficients of variation were found to be significantly associated with a number of urban characteristics. Most significant was a direct association with the percentage of low-income families and a negative association with the percentage of dwelling units owner-occupied
4. Noncentral cities are significantly less varied in residential quality than central cities. Moreover, the multiple regression equation developed for central cities cannot be successfully applied to predict the coefficients of variation of noncentral cities.

The study of intraurban variation of residential quality has hardly been exhausted since the above study is basically exploratory offering observation rather than explanation. However, the fact that the degree of variation exhibits regional similarities is sufficient excuse to speculate that here may be yet another means, if a minor one, of identifying and understanding regional differences in American cities.

ACKNOWLEDGMENTS

The author appreciates the aid of the following students who kindly helped in making several of the maps: Lionel Medeiros, Claude Clayton, Philip Yamaguchi, and Ian Macinol.

THE CONCENTRATION AND DISPERSION OF MANUFACTURING IN NEW ZEALAND

G. J. R. Linge

Dr. Linge, a graduate of The London School of Economics and the University of New Zealand, carried out field work in New Zealand in 1955–1958. He is at present Research Fellow on the staff of the Department of Geography, Australian National University.

TWO opposing tendencies, towards concentration and towards dispersion, are shown by the spatial arrangement of manufacturing in New Zealand. Though over 100,000 factory workers are employed in the five main centers of population the remaining 56,000 gain a livelihood in factories scattered throughout the length and breadth of the country.[1] This paper introduces a map of manufacturing in the Dominion, and analyzes the pattern so revealed by examining in turn the factors affecting the distribution of "material oriented," "market oriented," and "relatively footloose" industries.

One of the greatest problems involved in a geographical study of manufacturing in New Zealand is the lack of detailed statistical data. While employment figures are available for each town of 1000 or more population,[2] the smallest areas for which statistics of gross and net production, cost of materials used, and amount of wages and salaries are published regularly are the 25 employment districts shown in Figure 1. In practice the analysis of the geography of manufacturing by these districts has proved reasonably satisfactory; each district contains only one main urban area and, in most cases, the activities of the area tend to be focused on this town.

Given the availability of certain data, a further consideration is the most suitable way, or ways, of using this to describe cartographically the contemporary distribution of manufacturing. Single criterion maps have already been published[3] showing the number

[1] Some useful information about various aspects of manufacturing in New Zealand may be found in the following references: J. L. Hewland, "Manufacturing in New Zealand," *New Zealand Geogr.*, Vol. 2, No. 1. April 1946, pp. 1–16; J. K. Bewley, "Changes in the Pattern of Industrial Production in New Zealand from 1938–1954," *Proc. of First Geography Conference*, Auckland, 1955, pp. 43–51; G. C. Billing, "The Industrial Pattern and New Zealand's Future," *Econ. Journ.*, Vol. 68, March 1957, pp. 65–73; N. E. Dalmer, "Industry—Its Development and Importance in New Zealand," and W. B. Sutch, "Our Changing Industries: Some Reasons Why," both in *New Zealand Inventory and Prospect*, Wellington Branch, New Zealand Geographical Society, 1956; and G. J. R. Linge, "The Location of Manufacturing in New Zealand," *New Zealand Geogr.*, Vol. 13, No. 1, April 1957, pp. 1–18. Among *duplicated* papers should be mentioned: W. B. Sutch, "The Next Two Decades of Manufacturing in New Zealand," read to A.N.Z.A.A.S. Conference, Dunedin, 1957; *idem*, "Recent Developments in New Zealand Manufacturing," read to Auckland Branch, New Zealand Geographical Society, 1958; and G. J. R. Linge, "Some Measures of the Location of Manufacturing in New Zealand," read to the New Zealand Statistical Association, Wellington, 1957.

All statistics in this paper are for 1956 (or production year 1955–1956) and were derived from the *Report on Industrial Production*, annual, Wellington; *New Zealand Official Year-Book*, annual, Wellington; and from unpublished returns of the Department of Labour and Employment.

[2] Analyzed by L. L. Pownall: "The Functions of New Zealand Towns," *Annals Assn. of Amer. Geogrs.*, Vol. 43, 1953, pp. 332–350.

[3] G. J. R. Linge: "The Location of Manufacturing in New Zealand," *New Zealand Geogr.*, Vol. 13, No. 1, April, 1957, pp. 8–10.

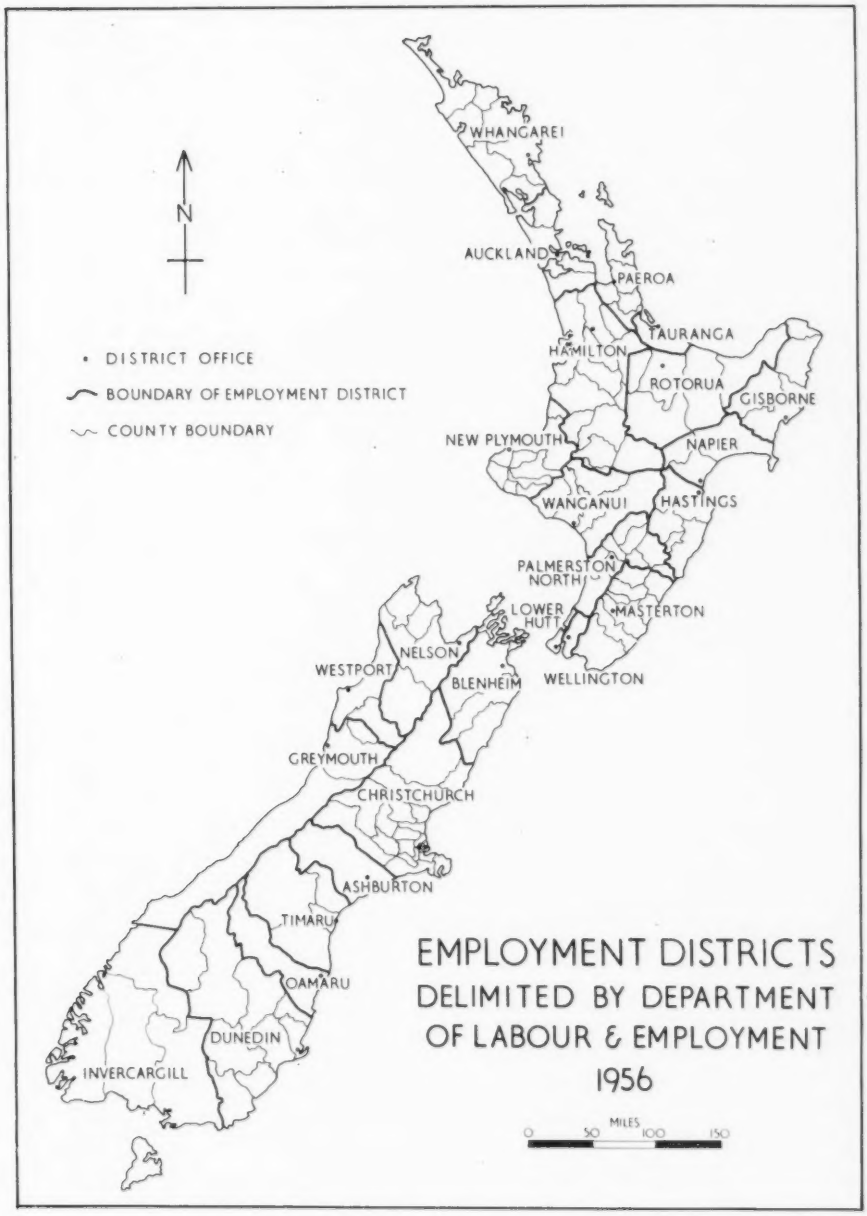

FIG. 1. The 25 employment districts of New Zealand for which statistics on manufacturing are published by the Department of Labour and Employment, and the Department of Statistics.

of workers and factories, the size of factories, and the amount of the net value of production by employment districts. However, these tend to emphasize the most obvious feature of the geography of manufacturing in New Zealand, namely the dominance of those districts in which the five main urban areas are situated. The 25 employment districts vary considerably in area, in size of population, and in economic structure, and these circumstances must be taken into account. One means to this end is the use of "location factors" derived from employment or value of production statistics to draw attention to "abnormalities" between districts, but these lend themselves more readily to graphic rather than cartographic representation.[4]

Of all the various ways which have been suggested for mapping the distribution of manufacturing, the most useful, in the light of the information available in New Zealand, seems to be that proposed by John H. Thompson.[5] Ratings of "magnitude" and "intensity" can be calculated for each district to draw attention not merely to the quantity of manufacturing therein but also to the importance of factory industry in the local economy.

As Thompson's own explanation of the methodology is readily available it need only be explained here that each of the two measurements depends on fixed bases which are averages of the conditions found in all employment districts, i.e., the Dominion average.

To compute a district's magnitude rating, (a) the number of workers in manufacturing; (b) the salaries and wages paid to factory workers; and (c) the value added during manufacture in this district are each divided by the respective base. These magnitude rating bases (the Dominion total divided by 25) are: (a) number of workers in manufacturing—6142; (b) salaries and wages paid—£NZ 3,935,000; (c) value added during manufacture—£NZ 7,417,000. The quotients derived in this way are multiplied by 100, summed, and then averaged to obtain a multiple-criteria rating.[6]

Similarly, to calculate a district's intensity rating the following ratios are divided by the respective fixed base ratios: (a) the number of workers in manufacturing to total population; (b) the number of workers in manufacturing to total labor force; and (c) the value added by manufacturing to total population. The intensity rating fixed bases (the above ratios for the Dominion as a whole) are: (a) 0.07; (b) 0.19; and (c) £NZ 85. The resulting quotients are multiplied by 100, summed,

[4] "Location factors" were proposed by P. Sargant Florence in *The Statistical Method in Economics and Political Science*, London, 1929, pp. 327–328, and *Econ. Journ.*, Dec., 1937, pp. 622–623. The method is further discussed and illustrated in *The Location of Industry*, P.E.P. Report, London, 1939. For discussion and illustration of the use of the "location factor" method for New Zealand employment districts see Linge, *op. cit.*, 1957, pp. 12–18.

[5] John H. Thompson: "A New Method for Measuring Manufacturing," *Annals Assn. of Amer. Geogrs.*, Vol. 45, 1955, pp. 416–436.

[6] The multiple-criteria rating of magnitude is calculated for the Whangerei employment district, for instance, as follows:

1. Actual number of workers in manufacturing—2,633
   Rating: $\frac{2,633}{6,142} \times 100 = 42.87$
2. Actual amount of salaries and wages paid—£1,716,406
   Rating: $\frac{1,716,406}{3,935,000} \times 100 = 43.62$
3. Actual amount of value added during manufacture—£3,777,000
   Rating: $\frac{3,777,000}{7,416,000} \times 100 = 50.93$

The multiple-criteria rating is thus:

$$\frac{42.87 + 43.62 + 50.93}{3} = 45.81$$

and averaged to obtain a multiple-criteria rating of intensity.[7]

The multiple-criteria magnitude and intensity ratings for New Zealand employment districts have been set out in Table I.

TABLE I

MULTIPLE-CRITERIA MAGNITUDE AND INTENSITY RATINGS NEW ZEALAND EMPLOYMENT DISTRICTS, 1956

Employment district	*Magnitude rating*	*Intensity rating*
Auckland	732	143
Christchurch	347	126
Wellington	231	130
Dunedin	179	106
Lower Hutt	158	158
Hamilton	108	56
Palmerston North	90	81
Invercargill	83	82
Rotorua	74	85
New Plymouth	74	78
Wanganui	56	72
Hastings	51	91
Timaru	47	68
Whangarei	46	50
Nelson	34	61
Masterton	29	65
Napier	29	58
Paeroa	25	64
Gisborne	25	53
Greymouth	19	65
Oamaru	17	79
Tauranga	17	50
Ashburton	16	62
Blenheim	13	45
Westport	5	32

[7] The multiple-criteria rating of intensity is calculated, again using Whangerei employment district as the example, as follows:

1. Actual number of workers in manufacturing—2,633; total population—83,222.

   Rating: $\frac{2,633}{83,222} \times 100 = \frac{45.20}{0.070}$

2. Actual number of workers in manufacturing—2,633; actual number of workers in labor force—27,200

   Rating: $\frac{2,633}{27,200} \times 100 = \frac{50.95}{0.19}$

3. Actual value added by manufacturing—£3,777,000; total population—83,222.

   Rating: $\frac{3,777,000}{83,222} \times 100 = \frac{53.41}{85}$

The multiple-criteria rating is thus:

$$\frac{45.20 + 50.95 + 53.41}{3} = 49.85$$

The dominance of the Auckland employment district, which has a magnitude rating more than twice that of any other, is pointed up, together with the leading positions held by the districts containing the other main urban areas—Christchurch, Wellington, Dunedin, and Lower Hutt. At the other extreme there is a considerable "tail" of districts each having a magnitude rating less than one-tenth that of Auckland. Figure 2 draws attention to the likenesses and differences when the districts are ranked according to each of the two ratings. In this way the importance of manufacturing in the economy of Lower Hutt, Hastings, Oamaru, and Ashburton is seen to be much greater than would be apparent from a ranking by quantity of manufacturing alone. In the reverse situation Hamilton district, for example, while ranked near the top (sixth) by magnitude criteria, is ranked near the bottom of the list (twentieth) by intensity criteria. It is not without significance that the same five districts, which between them have three-quarters of the quantity of manufacturing, also have the highest intensity ratings, and that Westport, Blenheim, and Tauranga districts having low magnitude ratings also have low intensity ratings.

The map of manufacturing in New Zealand, prepared by means of this adaptation of Thompson's methodology, is shown as Figure 3. The circles are proportionate to the magnitude ratings and shaded according to intensity ratings which have been divided into six classes. The four main concentrations of industrial activity (counting Wellington and Hutt together)[8] are widely

[8] Wellington and the Hutt Valley are only a few miles apart, and were recognized as separate urban areas for census purposes in 1951. They are still interdependent in many ways. For example, a survey in 1957 showed each day 12,000 persons traveled by road and

(*Continued on next page*)

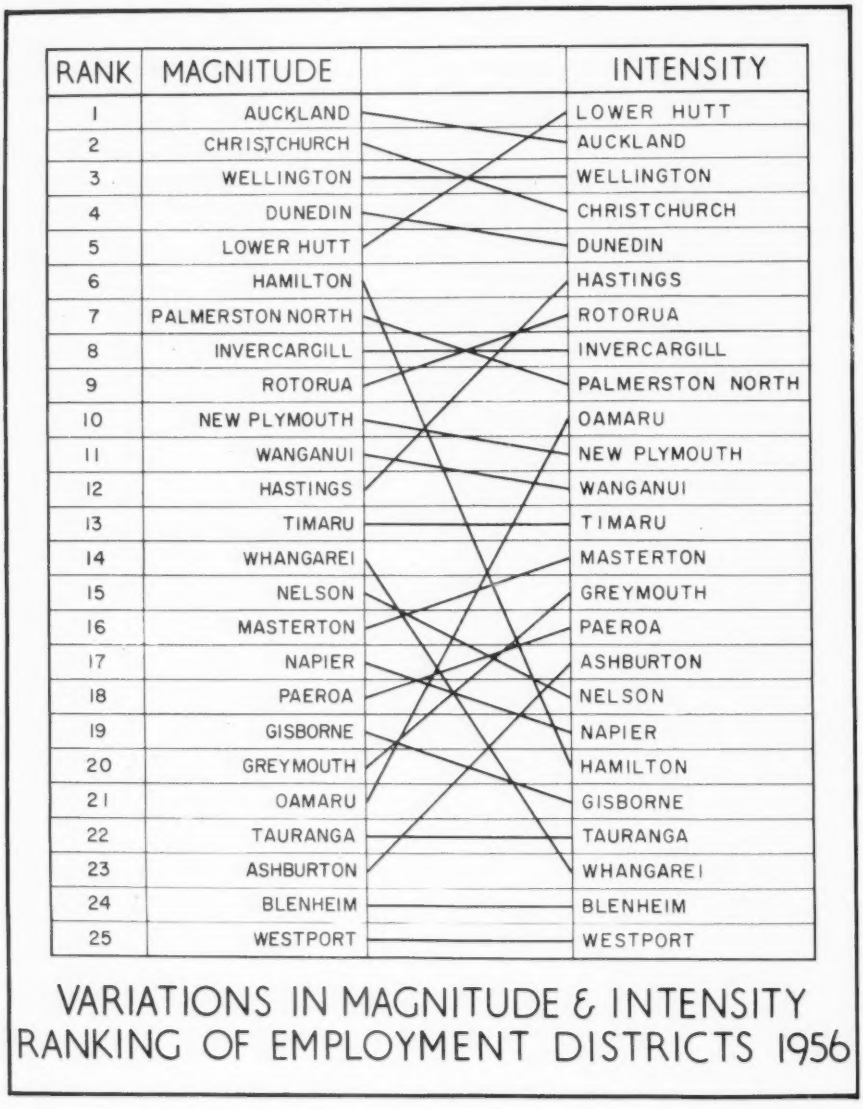

FIG. 2. Variations in ranking of New Zealand employment districts by the multiple-criteria magnitude and intensity ratings.

separated, and overshadow the much smaller amount of manufacturing in the districts between them. In the North Island 64 per cent of the quantity of manufacturing is in Auckland and Wellington-Hutt; in the South Island the concentration is even greater with 70 per cent in Christchurch and Dunedin.

rail from the Hutt Valley to work in Wellington, and about 2500 traveled in the opposite direction to their work.

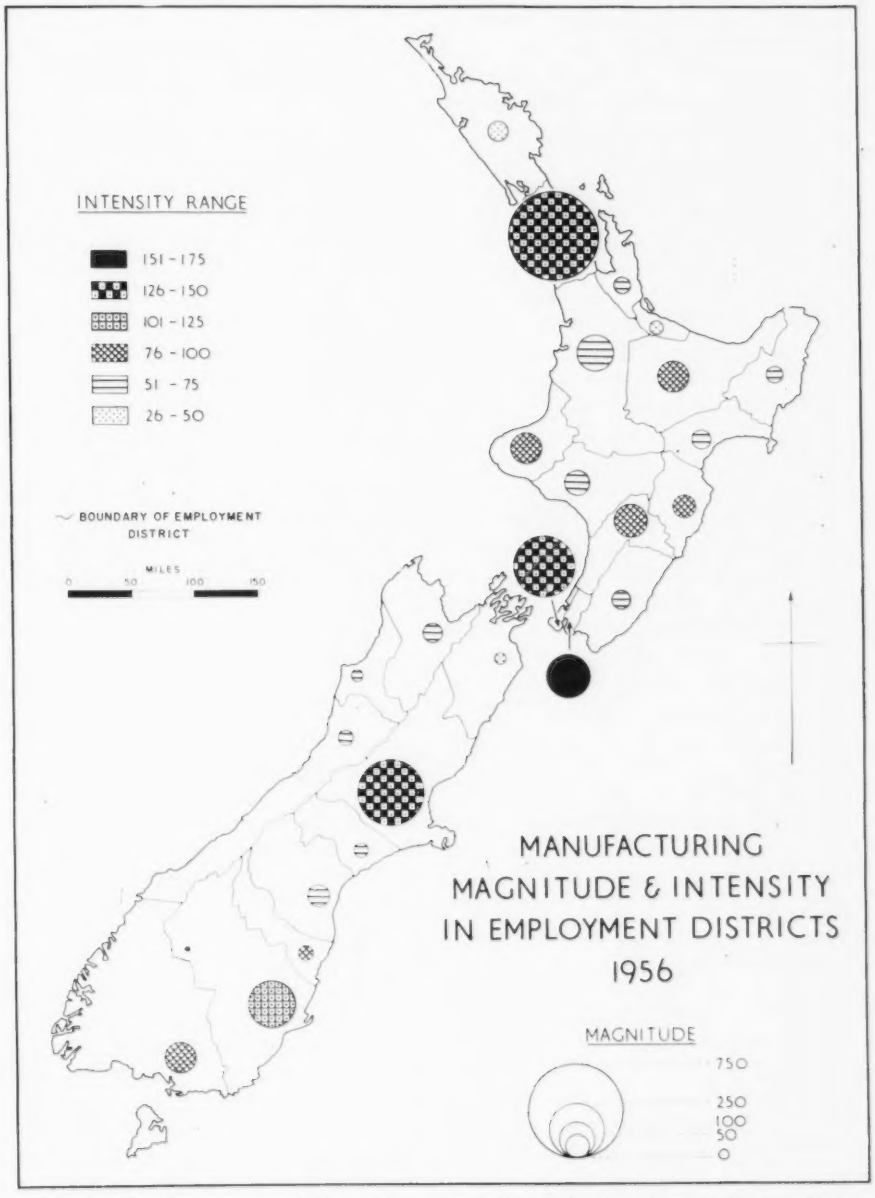

FIG. 3. Manufacturing magnitude and intensity in New Zealand employment districts, 1956.

INTERPRETATION

In interpreting this distribution of manufacturing, two basic and to some extent related influences must be mentioned at the outset. These are the shape and surface configuration of

New Zealand, with its effect on communications, and the development of the country in the early formative years, with its effect on the present pattern of settlement.

New Zealand, being a long, narrow country, bisected by Cook Strait, divided by mountains and dissected by rivers, has particular problems of transport and communications. The surface configuration made the construction of roads and railways both difficult and expensive as they have required numerous bridges, tunnels, culverts, and embankments, that all need constant supervision and repair. Not only has it been expensive initially to provide routeways but the costs of maintenance and operation have also been very high. To protect rail communications there are strict legal limitations on the use of road vehicles for freight hauls of more than 30 miles where rail service is available,[9] and long distance road haulage services on the Australian or American pattern are almost unknown. Furthermore, high rail charges on general freight subsidize the lower rates at which farm products and supplies are carried.

The difficulty of overland communication led to the early growth of local shipping services, although few rivers could be used for inland navigation. Coastal shipping is still used extensively, but freight rates are high due to the low turnover and the great cost of loading and unloading in New Zealand ports, and inconvenience is caused by delays to vessels and damage to goods.[10] Increasing use is being made of air freight, and particularly of a rail-air-rail service across Cook Strait between the North and South Islands.

The second fundamental influence stems from the way in which the country was colonized after permanent European settlement began in 1840. One hundred years ago New Zealand settlements consisted of six highly-confined "colonies." Those in the North Island were cut off from one another by "a tangle of profusely forested hills," and those in the South Island by "lofty alpine ranges, stark expanses of tussock grassland, and almost unfordable rivers running in mile-wide beds."[11] It was not long before physical and institutional barriers were overcome and communications between the settlements established, but meanwhile four townships—Auckland, Wellington, Christchurch, and Dunedin—had gained sufficient momentum to stand head and shoulders above all others. The wide gap which has always existed between the size (in terms of population) of these four towns and the next largest is one of the significant features of urban development in New Zealand.

During the latter part of the nineteenth century the population was equally divided between the North and South Islands,[12] so that the distribution of some of the early manufacturing industries, such as woolen milling, can be understood only by reference to this fact and the parochial outlook of scattered settlements. The rapid rise and decay of some towns due to gold rushes, and the longer term rise and fall of Dunedin, relative to

[9] See William H. Wallace: "New Zealand Railway Traffic Patterns," *New Zealand Geogr.*, Vol. 13, No. 2, October 1957, pp. 131–150; and "Railway Traffic and Agriculture in New Zealand," *Econ. Geog.*, Vol. 34, 1958, pp. 168–184.

[10] For example, freight rates ruling in 1958 were: Auckland to Wellington 85/–; Auckland-South Island ports 102/– (plus 5/– extra for discharge at Bluff); Sydney–N. Z. main ports 150/–; London to N. Z. main ports 327/6. These rates are per ton.

[11] K. B. Cumberland and R. P. Hargreaves: "Middle Island Ascendant, New Zealand in 1881," Part One, *New Zealand Geogr.*, Vol. 11, No. 2, October, 1955, p. 95.

[12] At the census of 1956, 68.7 per cent of the population was in the North Island.

the other main towns, have left behind legacies of industrial development which may appear incongruous when seen from the present day viewpoint.[13]

In the 1956 census two-fifths of the 2.2 million people were enumerated in the five main urban areas. Auckland and Wellington-Hutt are 425 miles apart by road and rail in the North Island, and Christchurch and Dunedin in the South Island are about 225 miles distant. There are only ten other urban areas having a population of more than 20,000 (none with more than 41,000), seven of these being in the North Island, and all but two located on the coast.

The way in which the distribution of "material oriented," "market oriented," and "relatively footloose" industries[14] have been affected by these and other considerations is now to be examined. It is recognized that this three-way division of manufacturing is a simplification of the actual position. Entrepreneurs take other organizational factors into consideration, such as the extent to which operations can be integrated with related processes and proximity to other industries. Indeed, just as there can be no precise grouping of the 100 industries into which New Zealand statistics are divided, it would be difficult sometimes to classify individual firms.

By means of statistical tests[15] and empirical research, including interviews at several hundred factories, an attempt has been made to evaluate tentatively the relative importance in New Zealand of these three groups of manufacturing. It seems that "material oriented" industries employ about 24 per cent of the factory labor force, "market oriented" industries about 25 per cent, and the "relatively footloose" industries about 51 per cent. On the basis of value added during manufacture the proportion contributed by each of the groups is, respectively, 32, 23, and 45, so that by either criterion the "relatively footloose" group is the most important. Each of the classifications is now further defined and analyzed.

"Material Oriented" Industries

Only industries relying on locally-obtained materials, that is the products of farm or forest, or those won from the earth or sea are included in this first group, the "material oriented" industries. Such a clear distinction is necessary when so much manufacturing depends on imported raw or semi-processed materials.

Secondary industries which process materials arising as products of primary activities show generally a dispersed pattern of location. In some cases the material is perishable (milk), or fragile (fruit); in others it is bulky (timber), or has a low value per ton (clay). Although most of these industries have been set up near their basic resource, obvious economies can be obtained if other locational requirements can be met at the same time. Hence, though export meat works are scattered throughout the Dominion

[13] For an elaboration see G. J. R. Linge: "The Geography of Manufacturing in New Zealand, 1840–1936," in *Proceedings of the Second New Zealand Geography Conference*, Christchurch, 1958, pp. 40–48.

[14] Terms used by, among others, Edgar M. Hoover: *The Location of Economic Activity*, New York, 1948.

[15] Including, among others, calculation of the "coefficient of geographic association" (also known as the "coefficient of linkage" and "coefficient of similarity") proposed by P. Sargant Florence, and the analysis of the ratios for each industry of wage costs and materials costs to total value of production. See, too, National Resources Planning Board, *Industrial Location and National Resources*, Washington, 1953; and Harold McCarty, John C. Hook, and Duane S. Knos, *The Measurement of Association in Industrial Geography*, Department of Geography, State University of Iowa, Iowa City, 1956.

most of them are sited near ports as it is more convenient to rail livestock to the works and to hold carcasses in cool storage until shipping space becomes available.

Usually mineral or forest resources are utilized as near to the market as possible; it costs from six to eight times as much to cart a 30-year-old crop of *Pinus radiata* for a distance of 100 miles as it does to grow the crop, and this is so even when the establishment and maintenance costs are compounded forward and included in the growing cost. More distant materials have remained what Zimmermann calls "neutral stuff,"[16] awaiting the development of a market which can bear the cost of transportation. In this way little of the annual growth of Golden Downs State Forest near Nelson is at present utilized even though there would be sufficient to maintain a pulp and paper works.

Within this generally dispersed arrangement there are industries which also show marked concentrations in particular parts of the country. Sawmills are numerous around Rotorua and Westport, and in the southern part of the Hamilton district, and dairy factories are concentrated round Hamilton and New Plymouth. Most of the fruit and vegetable preserving factories are localized near Hastings and Nelson so that fruit will not be damaged by long hauls, and vegetables can be quick-frozen from the fields.

The clearest example in New Zealand of a complete association between an industry and its raw material has been the development of a pulp and paper industry utilizing the exotic forests of the Volcanic Plateau of the North Island. There are two pulp and paper mills, a board mill, and several subsidiary enterprises processing nearby stands of *Pinus radiata*. Roads, railways, a new port, and other facilities, as well as three new towns, have been established during the last decade on what was, 30 years ago, a scrub-covered, treeless desert of pumice plains.

There are signs that modifications are taking place to some of these close associations between primary and secondary industry, as is illustrated by the processing of milk in the Waikato. Here, improvements to roads and the advent of bulk road-tankers is leading to a concentration of production at the more efficient dairy factories, and the "thinning out" of some of the smaller ones. The concentration of grain milling on the east coast of the South Island is a perfect example of geographic inertia. Originally established when most of the Dominion's wheat was grown on the Canterbury Plains or in Otago, these mills now rely principally on imported Australian grain.

"Market Oriented" Industry

Industries considered as "market oriented" are those providing goods for ultimate consumers in such a way that the association is almost a "tie" rather than merely an attraction. They are of three main types. Some make a perishable product such as bread which must be processed near the point of consumption; some, like custom tailoring, require personal contact with customers; others are tied to the market by reason of an increase in the bulk or weight of the product, the distribution of beverage factories throughout the country simply reflecting the high cost of transporting water. Such ubiquitous manufacturing is to be found everywhere, therefore, more

[16] Erich W. Zimmermann: *World Resources and Industries*, Rev. Edit., New York, 1951, pp. 12–13.

or less in proportion to population and income.

Under New Zealand conditions "market oriented" industries assume a special importance. The elongated shape of the country, the wide separation of the main markets, and the costs, delays, and damage involved in overcoming distance have discouraged regional specialization over an unusually wide range of manufacturing activities. Instead, these circumstances have fostered the establishment and protected the operation of many units engaged in similar trades throughout the Dominion. It is not possible, for example, to set up a factory at some nodal point from which the whole or even greater part of the national market can be reached quickly or cheaply. Thus, some industries do not operate at a national level; instead of Dominion-wide morning or evening newspapers there are 43 daily papers each circulating in a relatively small area and containing, therefore, a somewhat curious assortment of international, national, and local news.

"RELATIVELY FOOTLOOSE" INDUSTRIES

In contradistinction to industries which are oriented towards their materials or markets the remainder can be called "relatively footloose." Industries in this third group are *attracted* rather than *oriented* to particular parts of the country, and this distinction implies a wider although not infinite range of interregional choice.

Applied in its usual form to manufacturing, location theory makes several important assumptions about human behavior. Among these is the idea that the pursuit of profit is a dominant motive and that an industrialist would add together the costs of procurement, manufacture, and marketing at various points and would select the one which promised optimum net returns. Little evidence has, in fact, been found that manufacturers in New Zealand have much knowledge of costs in alternative locations. This is partly due to the inability to acquire such information readily from any public or private agency, and partly to the particular way in which most New Zealand factories are established. By far the greatest number of enterprises have been founded as small businesses employing less than a dozen or so workmen, and the examination of various interregional locations seemed to merit little, if any, attention.

Nowadays, firms that recognize divergences between actual and optimal locations consider that the costs of movement would far outweigh any gains to be obtained by moving to the better site or have set up branch factories to carry out processes in other parts of the country. Some overseas firms which have established themselves in the Dominion recently have attempted some sort of analytical appraisal of the relative advantages of various regions in the country but the majority of locational decisions still seem to be made on the basis of fairly broad considerations some of which are now described and illustrated.

TRANSPORT

The localization of so much of the "relatively footloose" industries in the five main urban areas is mainly a reflection of the fact that regional decentralization only becomes attractive when transfer costs are high. In fact New Zealand is "divided" by such costs, the reasons for which have already been mentioned, into a number of zones each focusing on a main center of population. Fragmentation of the country in this way leads to a position among "relatively footloose" industries

analogous in some respects to that of "market oriented" industries. More factories are operating in similar trades than might be expected for the total size of the market, and, as a corollary, the size of production unit tends to remain small and fairly closely adjusted to demand in a limited part of the country.

Some firms do, of course, serve a Dominion-wide market. Goods are produced which may be little affected by transfer charges such as instruments and costume jewelry, or which have a high value per unit of weight as in the case of fashion clothing. There are some industries, for example glass bottle and carpet manufacturing, in which the number of units operating in the Dominion is so few that the costs of overcoming distance can be absorbed into the price to the point where competition from overseas may have to be faced. In this way tariff protection may have suppressed in some cases the economic penalties of poor locational decisions.

Furthermore, some firms apparently in competition with others in the same trade are, in fact, operating under semimonopolistic conditions because of the acquisition of overseas manufacturing rights and the use of a world-famous brand name. Among others, underwear, swim suits, pharmaceutical preparations, and footstuffs, manufactured at only one factory in New Zealand and given fashionable, respectable, or safe names, are able to absorb transfer costs more readily.

Another aspect of transport is the way manufacturing is influenced by the use of imported raw materials. No less than 70 per cent of the value of New Zealand imports consists of producers' materials and equipment. In a study of the 1952–1953 national output figures[17] it was shown that in the "other manufacturing" account (as against the "processing of primary produce" account) £NZ114 m. of a total debit of £NZ437 m. was paid to the rest of the world for goods and services supplied. Moreover it is the manufacturing industries concerned with the processing of imported materials which have been expanding most rapidly since the beginning of the century.

In 1955 seventeen ports were used by overseas vessels and a further 20 by coastal vessels only. The range of possible choices seems wide but during the last three decades the greater size of overseas vessels, the inadequacies of accommodation in some of the smaller ports and increasing costs of all kinds have caused shipping lines to seek economies by concentrating operations at those ports where the greatest amount of cargo is offering. Two-thirds of the total tonnage of overseas vessels is handled by the ports of Auckland, Wellington, and Lyttleton (the outport for Christchurch) combined. The former two are used as the first port of call or 80 per cent of the overseas vessels (tonnage basis) and this is not without significance to manufacturers concerned with the frequency and regularity of overseas supplies.

As the four main ports in New Zealand—Auckland, Wellington, Lyttleton, the Port of Otago (Dunedin and Port Chalmers)—are each associated with a large center of population, an analysis of the relative attraction to "footloose" industry of ports, labor supply, and markets is made difficult. In practice few firms located at ports do not rely to some extent on immediate local markets, but there are some exceptions

[17] *Report on the Inter-Industry Study of the New Zealand Economy in 1952–1953*, Govt. Printer, Wellington, March, 1957.

such as the chemical fertilizer works in Auckland which rail all their products out of the urban area. The Colonial Sugar Refining Company's works at Chelsea (Auckland) is one of the very few instances of direct linkage between port facilities and point of manufacture.

MARKETS

Most factories in New Zealand are concerned with making complete goods for sale to the ultimate consumer. Only during the last few years has the market grown sufficiently large to permit some degree of specialization, but as yet few firms are wholly engaged in making goods for other factories to incorporate into products. In general, then, "relatively footloose" industries are more than usually influenced by the distribution of population and particularly by its rate of growth in various parts of the country. Figure 4 shows population mapped by employment districts and lays stress again on the dominance of the five leading urban areas. The overall consequences of a change in the rural:urban ratio from 43:57 to 37:63 during the last two decades are obvious, but more striking still is the rate at which some urban areas have expanded. Accounting for 57 per cent of the total population increase between 1936 and 1956, Auckland grew by 170,000, Wellington-Hutt by 65,000, Christchurch by 60,000, and Dunedin by 14,000. At this latter date no less than one-third of the New Zealand population lived within 100 miles of Auckland.

In its train this expansion of population has brought a substantial increase in community investment by local bodies and the government. No breakdowns are available of the cost of capital work being undertaken in various parts of the country. Visible evidence suggests, however, that a considerable proportion of the country's resources is being invested in the central and northern parts of the North Island. To some extent this is merely a reflection of population growth and the suitability of the Waikato River for hydroelectric power stations, and the Volcanic Plateau for afforestation and agricultural land development. Whether or not any particular part of the Dominion is receiving more than its "fair share" of investment cannot be substantiated, but it is probable that businessmen reviewing possible locations are considerably influenced by the prevalent *notion* that the area in and around Auckland is being favorably treated.

LABOR

The distribution of secondary industry has been affected by the shortage of labor since the Second World War. Expansion took place in most sections of the economy more rapidly than labor demands could be met by the normal growth of population even though this was reinforced by a substantial number of immigrants.[18] In 1947 factory industry was operating on about 90 per cent of its labor requirements, although in some trades, notably textiles and clothing, manufacturers were short of one-quarter of their needs.

Industrialists tried to meet this shortage in two ways. Firstly by establishing factories in the main urban areas where there was a large labor force, they tried to attract workers from other occupations with monetary and practical inducements. The advantages of being in a location deemed suitable from other points of view were considered to offset the higher direct and indirect costs of such labor.

[18] In the ten years ended 31st March, 1956, the population of New Zealand increased by 427,566 of which 98,045 represent a net gain of arrivals over departures.

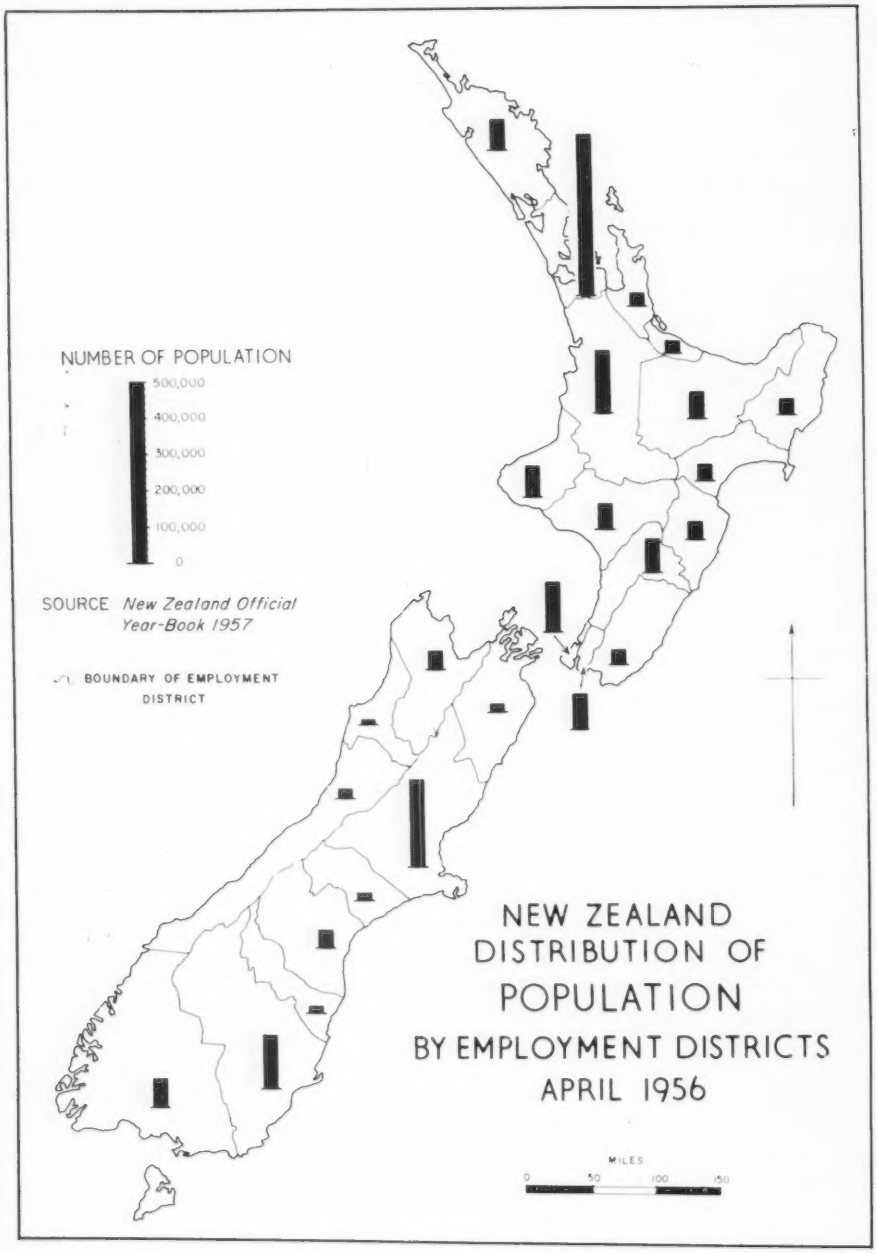

FIG. 4. Distribution of population by New Zealand employment districts.

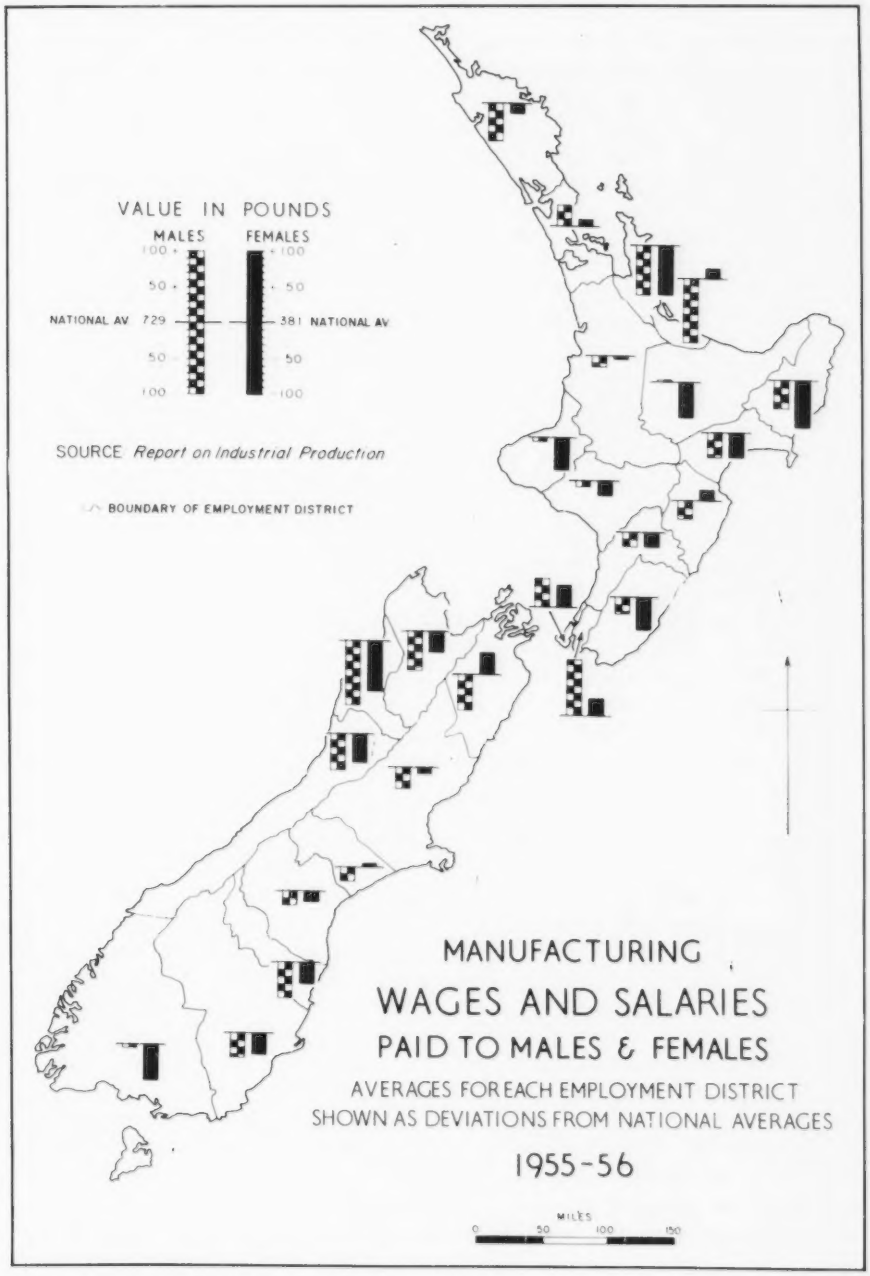

FIG. 5. Wages and salaries paid to manufactural workers in New Zealand employment districts during the production year 1955–1956.

Secondly, manufacturers set up branch factories in secondary towns to attract workers, particularly women and girls, who might otherwise not have entered the labor force at all. By March, 1947, one or more branch factories had been established in 24 small towns. This process of dispersion took place in light industries like the making of clothing and footwear, and more especially it affected those processes in which unskilled labor could be quickly trained and which required only simple, light and portable machinery. Some of these branch factories have since been closed and operations drawn together again at the parent factory, but the long-term plans of other organizations are not yet clear because of continued restrictions on capital expenditure.

Manufacturers seem little affected locationally by other labor considerations. Legislated minimum wage rates are strictly applied throughout the country although variations in actual wages arise due to above-award payments. Differences in earnings of male and female factory workers by employment districts are shown in Figure 5 for the production year 1955–1956, but an analysis of regional differences in hourly wage rates or overtime earnings is not possible from the statistics available. The concentration of heavy (relative to most manufacturing in New Zealand) industry in the Lower Hutt district, the ensuing competition for male labor and high wage structure have certainly deterred some industrialists from setting up in this area. Further obscuring the locational significance of wage rates is the extreme mobility of many kinds of labor between occupations, and, to a lesser extent, between different parts of the country.

On the whole the population of New Zealand is fairly homogenous. Differences in labor productivity arising from inherent personal qualities rather than from size of factory or other circumstances have not been studied in the Dominion but Figure 6 points up contrasts between employment districts, particularly those in the North and South Islands, in the gross and net value of output per "male equivalent."[19] No part of the country is affected by religious or political issues or has a particularly bad record of labor disputes. With the possible exception of Lower Hutt, where there is a concentration of motor assembly, refrigeration, and other engineering trades, industrial skills have not developed in "pockets," due to labor mobility and the wide range of activities in most areas.

GOVERNMENT ACTION

At no time has the New Zealand government had any overall plan associated with industrial development or interfered in any way with the locational decisions of manufacturers. It is true that the central government offered rewards to encourage various kinds of manufacturing in the nineteenth century but few of these bonuses stipulated the place of production.

The operation of the Industrial Efficiency Act passed in 1936[20] affected the location of only a few factories, the clearest example being the deliberate policy to permit three rubber tire factories to be set up—one each at Auckland, Lower Hutt, and Christ-

[19] The term "male equivalent" simply means "per worker" with three females reckoned as equivalent to two males, and is a concept used by, among others, the New Zealand Government Statistician.

[20] The Industrial Efficiency Act was designed "to promote the economic welfare of New Zealand . . . by so regulating the general organisation, development and operation of industries that a greater measure of industrial efficiency will be secured."

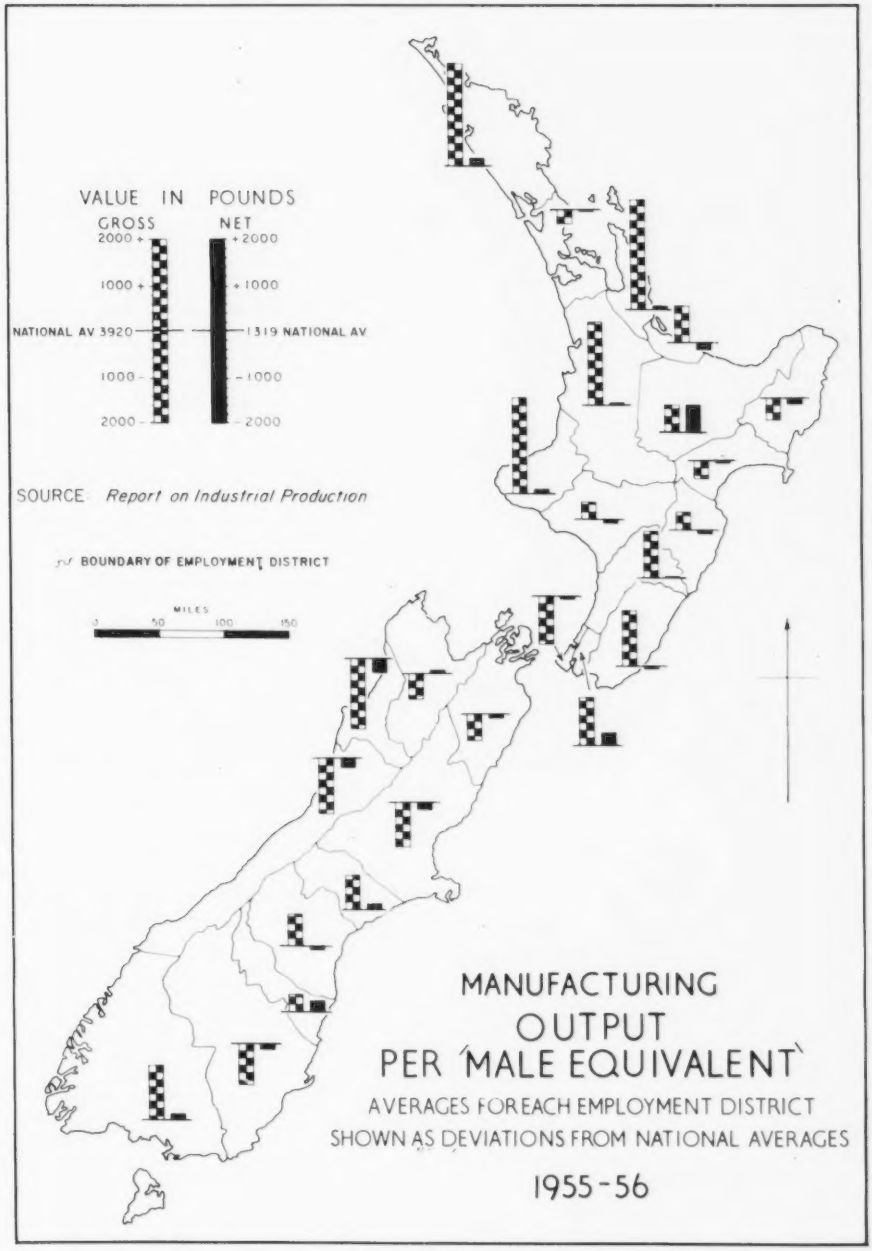

FIG. 6. Gross and net output per "male equivalent" in New Zealand employment districts during the production year 1955–1956.

church. During the Second World War man power was controlled and directed into essential industries, but the long term effect of this has been negligible. Since 1947 the government has made available some land and surplus warehouses but the acreage allocated in this way amounts to less than 200 acres.

MINOR CONSIDERATIONS

In the Dominion some locational considerations are of much less importance than in other countries. Thus, although industrial location has been affected greatly by climate, considered in its widest sense, as evidenced by the distribution of factories processing agricultural products; more directly the importance of precipitation, humidity, temperature, and side effects such as atmospheric pollution have had little interregional significance. There is some evidence to show that entrepreneurs prefer to live and work in sub-tropical Auckland rather than enduring the more rigorous winters in the South Island or the boisterous winds of Wellington.

Interregionally, other factors become of secondary importance because of the ubiquity of supply through the country. New Zealand factories depend on electricity for the major portion of their heat, light, and power, but the reticulation systems in the North and South Islands make it available over wide areas. It is believed that industrialists have taken little notice of the restrictions placed on power consumption from time to time, or of the slightly different tariffs operated by supply authorities (which draw the great bulk of their power from the State Hydro-Electricity Department) when considering factory location. Four-fifths of all solid fuel (excluding petroleum) is used by factories manufacturing food, paper and paper products, and non-metallic mineral products which in any case are fairly closely tied to raw materials. Only 34 gasworks operate in New Zealand and this considerably restricts the interregional choice open to gas-using or gas by-products industries.

Obvious advantages arise from ready contact between manufacturers and government departments, trade unions, banks, insurance and legal offices, as well as the universities and technical colleges. These "convenient" associations are possible only in the larger towns and, particularly, in the four main urban areas. Psychologically an entrepreneur can be influenced by the look or feel of a town or district, and Auckland, for example, where there is an atmosphere of activity and liveliness, may have a greater appeal to a businessman than more conservative parts of the Dominion.

Sometimes the circumstances leading to the siting of a factory cannot be understood except by reference to the personal idiosyncracies of the owner. Hence, an engineering works was set up in the foothills of the Southern Alps in the South Island because the founder owned a sheep station there,[21] and a plastics factory in Auckland because the owner was fond of sailing on the harbor.

SUMMARY

The spatial arrangement of manufacturing in New Zealand has been viewed in this paper as though it was made up of three broad, superimposed patterns. The first, of "material oriented" industries, follows the distribution of natural and man-made resources, and the second, of "market oriented" industries, more or less follows the

[21] See H. O. Pappe: "Manufacturing in New Zealand—A Specific Example," *New Zealand Geogr.*, Vol. 2, No. 2, October, 1946, pp. 329–344.

geographic arrangement of population. The third, of "relatively footloose" industries, is subject, however, to a much more complex series of influences.

It seems unlikely that there will be any marked change from the general arrangement of manufacturing in New Zealand during the next two or three decades. It is true that tentative plans are being drawn up for a steel furnace near Dunedin which would use North Island iron sands, local coal, and hydroelectric power, but it is probable that most of the output of such an enterprise would be sent to the North Island for actual fabrication. Suggestions have been mooted for aluminum and electrochemical industries, and although little definite information is available about these schemes they would almost certainly have to be in the South Island where there is available electric power generating capacity. Apart from these more spectacular developments, manufacturers will weigh much the same considerations as have been discussed in this paper.

There seems no reason to doubt that more than any other urban area Auckland, having most of the advantages and few of the disadvantages for secondary industry, will continue to draw to itself a considerable proportion of the new enterprises. More than any other part of the country this metropolis has become sufficiently large in terms of New Zealand conditions to operate as an integrated industrial unit, providing facilities for industrialists to bring together most conveniently the factors of production, and, at the same time, allowing them to reach one-third of the Dominion's population within 100 miles. Furthermore, the rapid rate of population increase, the expansion of forestry and farming, and the diversity of employment together give a visual and psychological impression of continuing prosperity in this area for the future. In short, Auckland will continue to provide a perfect illustration of the adage that "nothing succeeds like success."

ACKNOWLEDGMENTS

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INDUSTRIAL DEVELOPMENT IN EAST AFRICA

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MOST countries in Africa are predominantly agricultural and their economies are based on the export of one or two agricultural products subject to wide fluctuations in price. In areas with an expanding population demanding a higher living standard, but practicing primitive methods of cultivation and hampered by a subsistence economy, serious economic problems arise and there is a great need for a more diversified economy. Industrial development is usually advocated as a possible solution to this problem and has achieved considerable success in the Union of South Africa and Southern Rhodesia. But in East Africa the development of secondary industries suffers from many limitations such as the small size of the local market, low purchasing power of the bulk of the population, lack of skilled labor and poor quality of migrant labor, great distances and scattered population, lack of raw materials, and the difficulty of attracting capital to such a poorly-endowed region.

Kenya's modern history, and indeed that of East Africa too, may be said to have begun when the Kenya railway was completed in 1901 from Mombasa to Kisumu.[1] Industrial development has thus been very recent. The impressive achievements to date must be viewed against this modern historical background and a geographical background of a poor region with a harsh physical environment of semi-aridity over great areas, highly variable rainfall and lack of water supplies, poor soils, and vast areas infested with tsetse fly. East Africa consists of the three mainland territories of Kenya, Uganda, and Tanganyika, and the islands of Zanzibar and Pemba. They form a compact block of territory from 4½° north to 12° south, with a total area of some two-thirds of a million square miles, Tanganyika being by far the largest in extent.

The population is some 20 million (1956 estimate), 98½ per cent African, but with an important small minority of about 300,000 Asians and nearly 100,000 Europeans. Half the Asians and two-thirds of the Europeans live in Kenya. The population distribution maps of the East African Royal Commission show clearly the concentration of population in the higher rainfall areas. In many parts of East Africa, Africans are mostly at the subsistence stage, although the exchange economy has penetrated widely. There is a great need to overcome the basic poverty of the region and diversify the economy both by intensification of agriculture and the growth of commerce and industry. Indeed the success of industry will depend greatly on increasing agricultural productivity. There are de-

[1] Z. A. Marsh and G. Kingsnorth: *An Introduction to the History of East Africa*, 1957, p. 172.

velopment plans in each of the territories of Kenya, Uganda, and Tanganyika and much has been done to raise the standard of agriculture.

Before 1940 there was little in the way of industry in East Africa, but in the period 1945–1955 industrial development has forged ahead far more rapidly than could be envisaged at the end of the war. The wartime stimulus in supplying large allied armies in the Middle East, the continuing rise of prices for primary commodities, large-scale development programs, and the unexpected influx of capital are some of the reasons for this industrial growth. Kenya's geographical income increased by 23 per cent per annum for the period 1948–1955, and Uganda's money income nearly doubled from 1950–1955. Manufacturing has become of considerable importance in Kenya, its proportion of the geographical net product having risen from less than 9 per cent in 1947 to over 13 per cent in 1956; in 1939 there were only 40 companies, in 1956 nearly 3600. The volume of industrial production in Uganda and Tanganyika is less than in Kenya, and in East Africa as a whole industries account as yet for little more than a tenth of the national income.

MARKETS

According to the Economist Intelligence Unit, markets are of paramount importance in East Africa.[2] The market is almost entirely domestic, although there are exports of products like footwear and aluminum hollowware to other parts of Africa. The potential market is very large, and there is no doubt of the ability of industrial units in East Africa to meet this demand against competition from overseas. But this market is still comparatively small, limited by the African peasant's low purchasing power,[3] which in turn is kept down by low agricultural productivity. In Kenya much emphasis is being laid on the Swynnerton Plan begun in 1954, which aims at improving over half a million African plots so as to provide subsistence and a cash income of over £100 per annum for each peasant family, as compared with an average income of only £8 at present. It may be early yet to assess results, but an agricultural revolution will have been achieved if only part of the aims of the Swynnerton Plan are realized. The scale and pattern of the local demand for consumer goods has changed completely in the last 10 years. Africans are discriminating buyers with increasingly sophisticated tastes, and in areas like Buganda demand has progressed beyond the bicycle and gramophone stage to the wireless and motor car.

LABOR

Another factor of considerable importance is labor. Constant turnover, inefficiency, and consequent high costs of production hinder the growth of secondary industry in any backward, predominantly agricultural country. Labor migration is a marked feature of the economy over much of Africa, and it has developed particularly in areas where an exchange economy dominated by Europeans has become established, as in East and Southern Africa. Labor migration is largely due to the uneven distribution of population and great distances between centers of economic activity and concentrations of population, and the great demand for African labor in regions like the Kenya Highlands, Tanga, the Northern Provinces in Tanganyika, and in Buganda. Other

[2] *The Economy of East Africa*, prepared by the E.I.U. for the East African Railways and Harbours Administration, October, 1955, p. 125.

[3] Geographical income per head of population was only £20 in Uganda in 1956.

reasons are the desire of the African to retain a rural foothold, and low urban wages which make it difficult for him to maintain a wife and family in the town. Most Africans regard urban and industrial areas as places of temporary employment, although in Nairobi and Kampala a permanent urban African population is tending to develop and continuity of work and stability of labor to improve.

The supply of unskilled labor in East Africa appears to be adequate now, but there is a grave shortage of skilled labor. The East African Royal Commission Report points out that in 1948 approximately 73,000 Asians and Europeans were in paid employment constituting the main sources of skill and enterprise for the East African economy.[4] The number of non-Africans in paid employment had risen to about 110,000 by 1956. The shortage of skilled labor is at present a serious limiting factor to industrial development in East Africa. It is, therefore, essential to build up a strong class of artisans and technicians, and train Africans with sufficient ability and skill to take positions of responsibility in industry. Efforts are being made by the territorial governments to provide suitable training in technical and commercial subjects at various institutes such as the Royal Technical College in Nairobi and the Chagga Commercial College in Moshi. With help from the United States International Cooperation Administration, Kenya's pilot scheme to provide financial aid for traders and artisans has been widened to cover 13 districts. In Uganda, African traders are reported to conduct over one-third of Uganda's retail trade.[5] The Government helps by instruction in trading techniques and providing facilities for wholesale buying.

The major firms in East Africa are training African graduates for responsible posts in management. There is a certain amount of prejudice, though, against the newly fledged African graduate, and a tendency to employ the older type of African who has made good through long service and self-education. Employers are realizing more fully the value of tests for selecting labor, followed by training for particular types of work. Firms such as Batas at Limuru have carried out a considerable amount of research into the correct use of labor, achieving about three quarters of the output of a skilled worker in England under similar conditions. Another method of improving the quality of labor is to raise wages. In Kenya the Carpenter Report[6] recommended increasing African urban wages so that eventually a man could support his wife and family. As a result the statutory minimum wage has been raised considerably since 1954.[7]

Higher wages have led to a decreased labor force but despite this the value of industrial output has risen. Employers are tending to use their labor force more selectively. A policy of steady wage increases should encourage greater stabilization of African labor in manufacturing industries and a more even flow of labor from the rural areas.

The number of African adult males in paid employment in Kenya has nearly doubled and in 1956 it was over half a million, of whom about a quarter were engaged in industry. Tanganyika's paid labor force of African adult males was about 420,000 during the period 1954–1956, about 12 per cent engaged in industry. A comparable figure for Uganda

[4] East African Royal Commission 1953–1955 Report Cmd 9475, p. 108.

[5] Commonwealth Survey, January 10, 1958, p. 882.

[6] Report of the Committee on African Wages, 1954.

[7] 1954 Nairobi basic minimum wage including housing 63/– per month; 1st January, 1957, 105/– per month.

was about 225,000, more than one-third engaged in industry. This high proportion of industrial workers is due to the fact that much construction has occurred recently.

Table I shows the proportions of workers of each of the several races by industry groups for Kenya. The Africans are prominent in agriculture; Asians in public services, manufacturing, and commerce with very few in agriculture; and Europeans in public services, with a significant proportion also in agriculture, manufacturing, and commerce.

RACE RELATIONS

Perhaps the most important single factor in the growth of a sound economic basis in East Africa is that of race relations. The social and political atmosphere is at present somewhat troubled, and complicated by the need to balance the rights and desires of European settlers in Kenya and Tanganyika and Asians in all three territories with those of the Africans, in a region where the British government is committed to a policy of self-government and eventual independence.

LAND

There seems to be little difficulty in obtaining land for industrial purposes in East Africa, on a 99-year lease in Kenya and Tanganyika in planned industrial areas, and on a 49-year lease in Uganda, which is affected by the land policy of the Protectorate whereby land may not be alienated to non-Africans except for agricultural and industrial undertakings that will benefit the people of the Protectorate. In Kenya the East African Railways and Harbours Administration develops industrial plots served by rail, whereas in Uganda and Tanganyika territorial governments are responsible for such development.

RAW MATERIALS AND POWER

The economy of East Africa is preponderantly agricultural. Aridity over great areas, poor soils, and backward farming techniques limit the extent and range of crops grown; pastoralism is predominant over much of East Africa. Nevertheless, an increasing variety of crops is now being grown, and since 1945 there has been a steady rise in the value and volume of production. Some of the most important crops and livestock products are coffee, cotton, sisal, tea, pyrethrum, oil seeds and nuts, wheat, maize, wattle, hides, and skins. The processing of many of these products is an important part of East Africa's industrial economy, e.g., coffee curing works, tea factories, manufacture of dairy products, canning of fruit, vegetables, and meat, tanning of leather, etc. Cotton ginning and the processing of sisal employ many thousands of Africans. The growth of East Africa's industries is based primarily on improved agricultural productivity.

TABLE I

INDUSTRIAL EMPLOYMENT PATTERN OF THE WORKERS IN EACH OF THE MAJOR RACIAL GROUPS IN KENYA IN 1954 (IN PERCENTAGES)

	Agriculture, forestry, and fishing	*Mining and quarrying*	*Manufacturing*	*Building and construction*	*Commerce*	*Transport and communications*	*Public services*
Africans	44.8	1.1	8.3	4.0	4.3	1.5	26.5
Asians	1.9	0.5	19.9	7.7	27.6	4.4	30.7
Europeans	8.4	0.4	12.4	3.3	17.0	3.8	42.1

East Africa is not particularly fortunate in mineral resources as compared with central and southern Africa, and has lacked the stimulus for large-scale development such as copper in Northern Rhodesia and gold in the Union of South Africa. Mineral prospects are not very encouraging, and a number of mines have closed down, for example gold mines in Tanganyika. Tanganyika is, perhaps, the most fortunate of the three East African territories with respect to minerals, particularly with the production of diamonds, worth £3 million per annum, from the Williamson diamond mine now owned by the Tanganyika Government and De Beers Consolidated. In Uganda the major mineral produced is copper, which has been affected by the recent fall in prices. By far the most valuable mineral in Kenya is soda ash from Magadi, worth about £1½ million a year on an average. The completion of the primary geological survey in the three territories may reveal the presence of further minerals and oil or coal in exploitable quantities.

Because of the lack of basic minerals such as coal and iron ore, except in southwest Tanganyika at present too remote for exploitation, heavy industrial development is limited to activities such as the refining of copper at Jinja. Power is derived from water, wood, and imported oil and coal. East Africa has abundant supplies of potential hydroelectric power, particularly in Uganda. Kenya is relatively poor in hydro potential, but stations have been developed on the Maragua, Tana, and Thika rivers, and a major development is the projected Seven Forks scheme on the Tana River, 75 miles from Nairobi, which will supply some 100 mW. In addition, Kenya is now obtaining hydro power from the Owen Falls Dam in Uganda. The main 132 kV transmission line between Nairobi and Tororo was completed and accepted for service by the Kenya Power Company in September, 1957, and bulk supplies from the Uganda Electricity Board came into operation at the end of 1957.[8] The Mombasa area is largely supplied by thermal plants, but some hydro power is obtained from the Pangani Falls, the largest single source of power in Tanganyika. The hydro capacity of the Pangani Falls may be increased in the future if capital can be raised. There are also small hydro stations at Moshi, Iringa, and Mbeya, whereas the rest of Tanganyika is supplied by thermal stations.

Uganda has ample supplies of hydro power from the Owen Falls Scheme which has an installed capacity of 150 mW. There is already talk of constructing a second dam on the Victoria Nile a few miles downstream from the Owen Falls Dam.[9] The crux of the matter is the African ability to pay for more power. There are also political complications, and Kenya may well be desirous of developing independent sources of power to lessen undue dependence on Uganda. A major problem in the development of hydro power is the heavy initial cost of installations and subsequent cost of transmission lines. Nevertheless, the demand for electricity has increased greatly, e.g., in 1946 the E.A. Power and Lighting Company supplied only 18,452 consumers and in 1957 there were 83,483. East Africa probably has sufficient hydro power potential to cater for greatly increased industrial development for the next 15 to 20 years.

[8] Annual Report of the East African Power and Lighting Co. Ltd., *Times*, September 16, 1958.

[9] The E.I.U.'s *Power in Uganda* suggests that a second dam should be commenced by 1960 at a cost of at least £13 million.

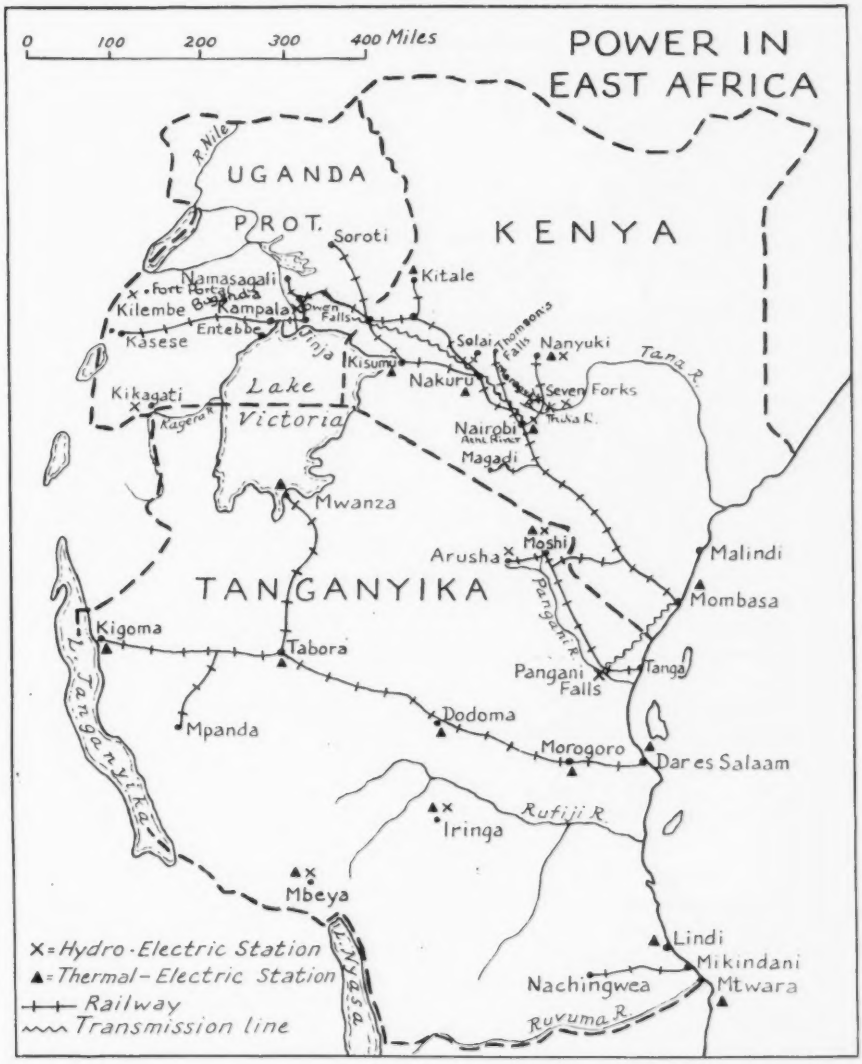

FIG. 1.

TRANSPORT

It is a platitude to state that poor transport facilities are a serious limiting factor to economic activity. Before the railway was built the cost of head porterage from Uganda to Mombasa was up to £300 per ton, whereas rail freight on cotton lint from Uganda to the coast is now under £5 per ton. The lack of adequate communications is particularly apparent in the southwestern regions of Tanganyika. The Great North Road, with a surface badly corrugated in places and liable to be cut off by floods on occasions, is the main link between Tanganyika, Central Af-

rica, and the northern part of East Africa. There have been recent proposals for upgrading this route to international standards. The suggested rail link between the Northern Rhodesian system and the Central Tanganyika line is at present economically unfeasible. Another serious gap in the existing railway system is between the Central Line and the Kenya-Uganda Line.

There has been considerable extension of the railway network and improvement of habor facilities recently, owing to postwar economic development, e.g., the 208-mile Kampala-Kasese railway extension and provision of new deep water berths at Mombasa, Dar es Salaam, and Mtwara. Congestion has been eased and delays in shipping have stopped at Mombasa. The railways, which bore the brunt of two wars and the depression of the early 1930's, have been placed on a sounder financial footing since amalgamation in 1948. Railways have been the backbone of economic development in East Africa. The changing direction of trade, with more interterritorial movement of goods north and south and to central Africa and less of the east-west exchange of products from the interior to the ports, emphasizes the need for greater north-south links.

Future development of the communications pattern may well depend more on improved roads than on railways. Costs of road construction and maintenance are heavy in tropical regions such as East Africa which lack road surfacing material, are subject to floods and sudden fluctuations of water level, and have wide river valleys. In Uganda extensive swamps, rivers, and lakes necessitate numerous bridges and causeways. Tarred roads have been constructed recently in the most advanced economic areas such as Buganda, Nairobi, Moshi, Arusha, Tanga, and Dar es Salaam. Road mileage in Tanganyika has increased from 16,500 to over 19,000. However, in view of the probable future development of inter-African trade, more emphasis should be laid on improving existing roads. East Africa's inland waterways, in contrast to those of South Africa, are of great importance. This is particularly true of Lake Victoria, which carries a considerable export traffic in cotton and coffee and is the main focus of traffic between the three territories. In 1956 the Kenya, Uganda, and Tanga sections of the East African Railways handled 4.6 million tons of freight and 4.1 million passengers. Road Transport Services in Tanganyika operate over a distance of 1631 miles and are important links in regions not served by railways.

CAPITAL

In the 10-year period following the Second World War there was a marked inflow of capital, much of it from overseas, from the British government and from great industrial concerns like I.C.I., Unilever, and Portland Cement which have established subsidiaries in East Africa. But in Uganda the bulk of the capital has come from price assistance funds, which have been used to help finance large-scale plans, such as the Owen Falls Scheme and the Kilembe Copper Mine. Some £18 million from a total of £38 million has been held back from cotton growers for such economic development. These funds were set up after the war to safeguard the grower and minimize the risk of inflation, which would undoubtedly have occurred if the whole value of the crop had been passed on to the grower. Forced saving for development purposes has proved beneficial to Uganda. But prices of cotton and coffee have fallen steadily of late and the stabilization fund is being depleted.

FIG. 2.

In 1952 the Uganda Development Corporation was set up to improve existing and help establish new industrial enterprises. The Government is the sole shareholder and the Corporation enters into partnership with established commercial or industrial firms.[10] It has sponsored major undertakings like the Owen Falls Dam and is now engaged on a wide variety of schemes such as fish marketing, copper mining, hotel and property management, tea growing, and the manufacture of cotton textiles. In

[10] East African High Commission, *Some Notes on Industrial Development in East Africa*, September, 1956, pp. 34 and 35.

Kenya the Industrial Development Corporation established in 1954 helps to initiate and aid the development of industry.

In Tanganyika in 1956 a Commissioner for Commerce and Industry was appointed to further the establishment of industry. The East African Industrial Council, reconstituted in 1948, assists the High Commission on matters of industrial policy and development of industries on an East African basis. Industry is protected by a 22 per cent import duty on general goods; generally plant and raw materials required for agricultural and industrial use pay no duty.

GENERAL

Industrial development has been very rapid compared to prewar and now a wide range of products is manufactured as indicated by Table II and Figures 2 and 3.

In 1956 the total numbers employed in industry, including mining, quarrying, building and construction, and electrical contracting, were 83,318, and value of gross production was nearly £70 million, an increase of £20 million since 1954. In Kenya agricultural processing is by far the most important branch of industry, with products worth over £23 million in gross value in 1956, although the largest employers of labor are those factories producing wood products and furniture. Chemical products worth over £5 million were second in value of gross production. Kenya is by far the most important industrially of the three East African territories. In 1956 it exported over £2½ million worth of cigarettes, about £¾ million worth of beer, and nearly £½ million of wheat meal and flour as well as significant quantities of cement, sisal bags and sacks, clothing, footwear, dairy products, steel doors and windows, nails, household utensils, etc., to the other two territories. The maps of industries and power in East Africa indicate the concentration and fairly wide range of light industries in the Nairobi area.[11] The other main area is in Mombasa. The majority of the industries are small, except for brewing, flour milling, and cement. Uganda's light industries are concentrated mainly in the Kampala, Jinja, and Tororo districts; in Tanganyika, Dar es Salaam is by far the most important of the industrial areas.

[11] The Nairobi industrial area includes Thika and Athi River.

TABLE II

KENYA SURVEY OF INDUSTRIAL PRODUCTION 1956

	Number of establishments	*Numbers employed*	*Value of gross production in £000,000*
Meat, dairy, and canned products	32	2,901	5.8
Grain mill products	46	2,332	6.7
Miscellaneous foods	71	3,576	3.4
Beverages and tobacco	36	3,934	7.9
Textile products	97	3,048	1.9
Footwear and repairs	65	1,075	0.9
Wood products and furniture	232	10,224	3.3
Paper products and printing	65	2,390	2.4
Chemical products	46	3,685	5.2
Clay and glass products	34	2,794	2.7
Metal products	67	2,240	2.7
Machinery	43	1,751	1.3
Transport equipment including repair	179	5,303	3.3
Miscellaneous manufacture	35	738	1.0

Source: Commerce and Industry in Kenya 1958, Appendix 7.

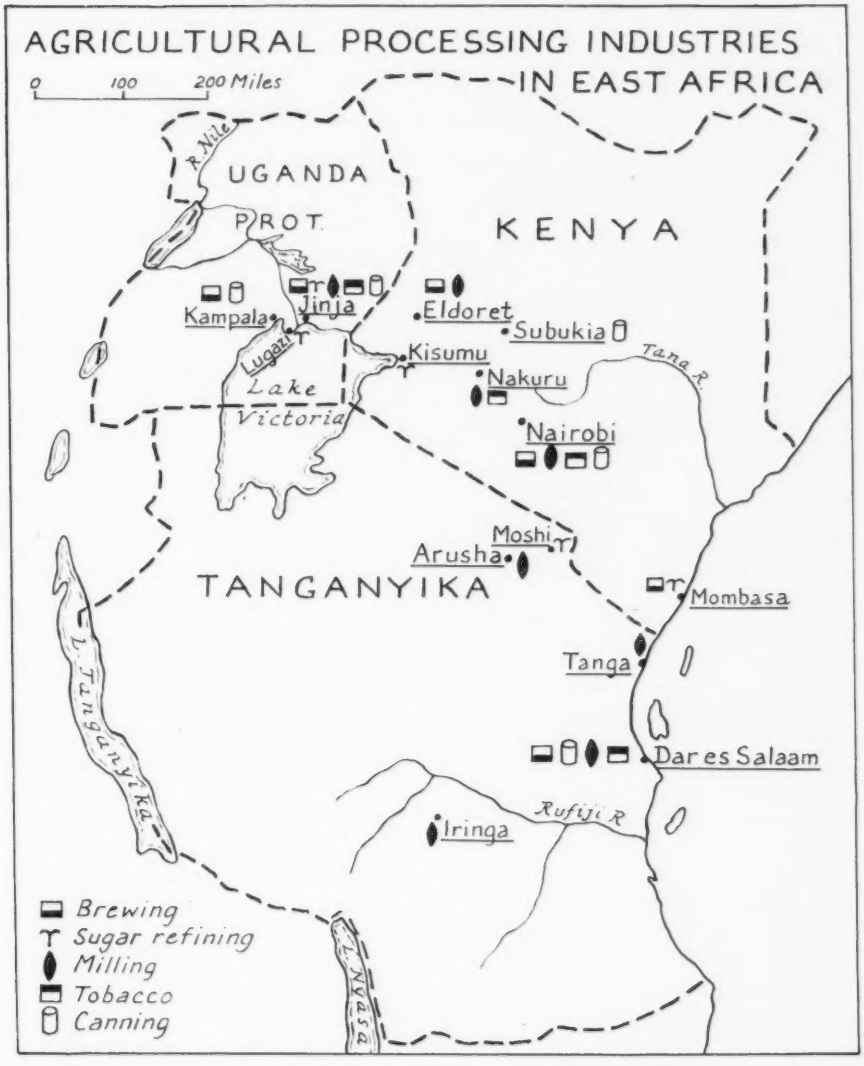

FIG. 3.

The brewing industry has developed greatly since the war, mainly because of increased African demand. In 1957 Uganda produced nearly 1½ million gallons of beer. In 1956 Kenya exported over 400,000 gallons of beer to Uganda (worth nearly £¼ million) and nearly double this amount to Tanganyika. Breweries are one of the most successful industrial enterprises. Although great quantities of local beer are brewed by Africans they are unable to produce the European type of beer which is sufficiently like their own to be popular. There are three breweries in Nairobi, and one brewery each at Mom-

basa, Dar es Salaam, Fort Portal, and Jinja.

Flour milling is a well-established industry and supplies all East Africa's needs. It is based on wheat produced in Kenya and to a certain extent in Tanganyika; hard wheat has to be imported from Australia. Nearly 100,000 tons of wheat were produced in Kenya in 1957. Ungas, a subsidiary company of the Kenya Farmers' Association (Co-operative) Limited, are the largest operators. There are mills at Eldoret (capacity 40,000 tons), Nairobi (capacity 50,000 tons), a large new mill at Nakuru, and others at Jinja, Arusha, Iringa, and Dar es Salaam.

Until the beginning of 1954 nearly all East Africa's requirements of cement had to be imported, but now, with factories at Mombasa, Athi River, and Tororo, the output of cement is almost sufficient for local needs. The capacity of the Mombasa factory is being increased to a quarter of a million tons. In 1955 and 1956 the production of cement in Kenya was 130,740 and 183,600 tons respectively, whereas in 1957 Uganda produced 85,500 tons. Cement asbestos products are being made at Tororo; in 1957 over 4000 tons of products of all types were produced.

Nyanza Textiles Ltd., at Jinja, equipped with a most modern factory and equipment costing £2 million, commenced the production of cotton sheeting in 1956. This proved difficult to sell at first for a number of reasons: Africans prefer a cheaper inferior cloth from India, Asian merchants are reluctant to handle locally produced cloth, and costs of production are high owing to small output and expensive labor. But demand has increased and cloth is now being produced at the rate of more than 10 million yards per annum, and new machinery has been ordered to cope with the demand.[12]

There is a small factory at Moshi which bleaches and dyes imported cloth. Uganda is by far the largest producer of cotton textiles, and if production costs can be kept down demand should increase steadily and the Jinja mills might form the basis of an important textile industry.

PROSPECTS

The continued growth of industry in East Africa depends on such factors as increased agricultural productivity, improved communications, a more efficient labor force, higher output, and lower production costs. With falling commodity prices, the rapid rate of development is now tending to slow down, but a great deal has been achieved. The contribution to the national income by manufacturing industry in Kenya has increased from 8.5 per cent in 1947 to 13 per cent in 1955, and the net value increased from £4½ million to nearly £21 million in the same period.

Little mention has been made of social and political factors, as this has been an economic survey. Europeans and Asians have played a major role in East Africa's economic development, particularly in Kenya and Tanganyika. Africans desirous of further economic growth are highly suspicious of the great economic and political influence possessed by Europeans and tend to fear the influx of further immigrants and capital from oversea. These suspicions must be allayed, as East Africa can only progress economically with European and Asian enterprise and capital. The British government maintains that social and political advance can only come if built on a sound economic basis. Some African politicians talk of political freedom first to be followed by economic growth.

[12] Barclays Bank Overseas Review, September, 1958, p. 34.

ON WRITING THE GEOGRAPHY OF STRANGE LANDS AND FARAWAY PLACES—AFGHANISTAN, FOR EXAMPLE

A Review Article*

Aloys A. Michel

Dr. Michel is Assistant Professor of Geography at Yale University. His field research in Afghanistan during 1957–1958 was sponsored by the National Academy of Sciences—National Research Council and the Office of Naval Research. The results of his work were published by the Academy-Research Council in 1959.

THIRTY or forty years ago, when the world was still young, the explorer or traveler occupied an honored place among geographers. Learned, or at least well-endowed, societies hastened to finance "expeditions," and thousands of devotees were enthralled by the words and transparencies of voyagers returning from darkest Africa, the polar regions, or the forbidden kingdoms of Central Asia. The quality of the contributions to learning ranged from the carefully-recorded, voluminous reports of a Sven Hedin or Aurel Stein to the journalistic popularizations of Lowell Thomas and Richard Halliburton.

With the growing sophistication of science in general we have come to expect far more from our foreign field researchers, and rightly so. We are well along in the age of the specialist, and a geographer returning from a strange land or faraway place must do far more than provide a description of its scenic beauties (he has his 35mm. color slides for that) or the odd customs of its inhabitants. He must provide analyses of its geological and geomorphological history, fit its climatic variations into some accepted scheme of classification, give genus and species for its flora and fauna, and present mechanical and chemical analyses of its soil types. If he claims to be an economic geographer, he must describe the country's regional land use patterns, its agricultural and industrial productivity, its import-export data, and the fiscal position of its government. The cultural geographer must trace the ancestry of the nation's ethnic groups—their role in its history, their present location and proportions, and their social structure and political proclivities. To the extent that any of this information lends itself to statistical presentation—in charts, tables, graphs, index numbers, or correlation coefficients—the modern geographer is expected so to present it. Thus the standards of the science are being raised and the prevalence of generalities reduced, and the researcher while in the field probably tends to observe and record more accurately since he knows just what will be expected of him when he publishes.

At the same time, however, the costs

*This article was inspired by Dr. Michel's experiences in the field and by the recent publication of Johannes Humlum's *La Géographie de l'Afghanistan* (Copenhagen: Gyldendal, 1959) 421 pp., $40.

of foreign field research are rising, the number of well-equipped "expeditions" is decreasing, and the individual geographer finds it increasingly difficult to spend sufficient time in the field to do justice to the many specialties of his eclectic discipline. The response of some is to stay close to home, to limit their research to microgeography, or to choose some viable specialization. Yet there remain regions which have not yet been visited and many others which have not been mapped; or were mapped on so small a scale, so haphazardly, or so long ago as to remain virtually "uncharted." It is paradoxically true that we may soon have a more detailed cartographic knowledge of the far side of the moon than of parts of our own planet.

Furthermore, there exist many societies which are oblivious to recorded history and which have only a dim or fanciful knowledge of their own past. Other societies, including the Afghan, have a high regard for history but little concern for statistics. The average Afghan merchant is very good with numbers; he probably makes fewer errors on his abacus than the average supermarket clerk at her register. But he is not so good at estimates, whether they be of the number of people in his quarter or of the distance to the next town. The same is true of the Afghan farmer, who knows by heart the metes and bounds of his fields but has no idea of how many *jiribs* (1 *jirib* = .482 acres) they encompass, and of the nomad, who knows the number (and quite probably the individual physiognomy) of the sheep and goats in his care but not the number of *gaz-i-chaks* (Kabul yards) they have traveled in the last 24 hours. In all three cases—merchant, farmer, and nomad—other information is known but "withheld" when it comes too close to home, just as it is in the United States Census of Manufactures. That is to say, the merchant will not tell you his turnover or costs, the farmer won't divulge the number of his sons (and you cannot ask him about the daughters), and the nomad won't list the items he has brought in with him from Pakistan. After all, you might be a spy from the government looking for tax delinquents, draft evaders, or smugglers.

Not only the field researcher but the government of a nonstatistical society labors under these handicaps. The central government finds it very difficult to hire or to train statisticians, and almost impossible to obtain data and to maintain reasonably correct records. Even the provincial registers of vital statistics and land holdings are inaccurate and often deliberately distorted.

Enough has been said to indicate the problems facing the geographer who chooses for his field of study a region which is physically and spiritually remote from our Western society. They are multiplied enormously when he attempts to prepare a definitive geography of an entire "strange land." Presumably, according to the newer standards of the science, a geographer can do a much more satisfactory job in New Jersey than in New Guinea. But fortunately, in this writer's opinion, some geographers are not interested in New Jersey, and, besides, someone has to make a start in New Guinea—or Afghanistan.

A GEOGRAPHY OF AFGHANISTAN

Considering these handicaps and limitations, Johannes Humlum's *Géographie de l'Afghanistan* is an outstanding success. While he was able to spend only about three months in the field, he was fortunate in being there as a member of an expedition, the Third Danish Expedition in Central Asia (1947–1954). After his return to the University of

Aarhus in 1948, Professor Humlum was able to draw upon the findings of other members of that expedition, those of Dr. Mogens Koie and Dr. Klaus Ferdinand in particular. He has also gone through a substantial portion of the extensive though scattered bibliography on Afghanistan which, in 1956, was found to include some 1068 items.[1] The result is the first comprehensive geography of Afghanistan and, apart from M. G. Pikulin's *Afghanistan: Ekonomicheskii Ocherk* (Tashkent: Academy of Sciences of the Uzbek SSR, 1956), the first serious economic geographic study by a non-Afghan author. Humlum's work immediately takes its place alongside Sir Percy Sykes' *History*, Fraser-Tytler's political study, and the Human Relations Area File Country Survey, edited by Donald N. Wilber, as a basic reference for anyone interested in Afghanistan.

While the geographical literature on Afghanistan includes a number of generalized surveys, regional studies, and geological interpretations by such Afghan authors as Mohammed Akram, Mohammed Ali, Ahmad Afi Kohzad, and Sultan Popol; the French geologists Raymond Furon and Louis-Félicien Rosset; the German geologists Herbert Tichy and Emil Trinkler; and the Russian botanists N. I. Vavilov, D. D. Bukinich, I. A. Linchevski, and A. V. Prozorovski, Dr. Humlum may legitimately be credited with a pioneer work in this field. He has produced what was most sadly lacking: a careful and detailed frame of reference upon which further studies may build.

Dr. Humlum's *Géographie*, quite apart from its original contributions and valuable interpretations, provides a one-volume compendium of the most important geographical information available on Afghanistan. Three hundred and sixty-four pages of text are supplemented with a glossary of common Afghan (Farsi or Pushtu) terms, weights and measures, tables facilitating the conversion of English measure into the metric system, Fahrenheit temperatures into Centigrade, acre-feet into cubic meters, second-feet into cubic meters per second, and bushels per acre into quintals per hectare. Would that all authors were so considerate!

The 16-page index is a further indication of the thoroughness and care with which this book has been produced. The small-scale maps and the 135 photographs and line drawings used in the text are visually indexed on outline maps of Afghanistan, while all 78 large- and small-scale maps and diagrams are also listed by title. The book is beautifully printed on sturdy, glossy paper, well suited to endure as well as to show off the merits of the photos which make this the best-illustrated work on Afghanistan since the pictorial study by E. Caspani and E. Cagnacci—*Afghanistan, Crocevia Dell'Asia* (Milan, 1951). Quality has not been sacrificed in publishing the Humlum work, but it is undoubtedly and unfortunately the lack of a large and ready market which is primarily responsible for its high purchase price.

Having set forth in no uncertain terms the merits of Humlum's work, it remains to analyze his methods, contributions, and conclusions in the context of the general handicaps previously described and the specific handicaps peculiar to Afghanistan. By and large, such criticism must be constructive, for no one seriously interested in Afghan studies can fail to greet Humlum's book with open arms. If one disagrees with some details, or is unhappy at some interpretations, the overwhelming reaction remains one of pleasure that there

[1] Donald N. Wilber, *Annotated Bibliography of Afghanistan* (New Haven: Human Relations Area Files, 1956).

FIG. 1.

is at last something substantial in print with which to take issue in a small degree.

MAPS AS A SUBSTITUTE FOR FIELD OBSERVATIONS

One point which leaves me unhappy is that so much of Dr. Humlum's descriptive geography consists of what I would term "map reading." He and his colleagues at the Geographical Institute of the University of Aarhus have spent a great deal of time in making planimetric determinations of the areas of Afghan provinces, natural regions, drainage basins, etc., and in computing the lengths of streams and the elevations of towns and passes, etc. When the amount of time a geographer can spend in the field is limited, and it almost always is in "strange lands and far-away places," this is one method of supplementing visual observation and direct experience. But it is no substitute for them. And when the maps in use are as old and unreliable as these[2]

[2] The 1:1,000,000 GSGS/AMS edition, sections of which are based on such sources as "Rigourous survey 1918–32," "Reconnaissance survey 1879–1920," and "Reconnaissance survey 1878–98;" and the Quarter-Inch Map (1:253,440) which is even poorer and wherein contours degenerate into mere form lines.

one seriously questions the value of the results so painstakingly derived. Of course, they are better than nothing, and one is grateful for some planimetric approximations with which to work until better maps come along. Then, they will have to be done all over again.

The great pity is that a far superior map of most of Afghanistan is already in existence, though apparently unattainable. I refer to the maps prepared for the Royal Afghan and United States Governments by means of the aerial survey made by Fairchild Aerial Surveys, Inc., in the autumn of 1957, costs of which were shared between the two governments.[3] Strips were flown at an altitude of 32,000 feet and, although a 50-mile wide zone south of the Afghan-Soviet border was excluded, maps of the entire surveyed area on a scale of 1:250,000 with 100-meter contours and of some sections on a 1:50,000 scale are now in existence though not accessible to the general public including geographers. Map interpretations and calculations from these sheets, or directly from the photo mosaic, would immediately put our knowledge of Afghan topography, cultivated areas, drainage basins, and even geological structure upon a comparatively sound basis.

CLIMATE CLASSIFICATION

In dealing with the climate of Afghanistan, Dr. Humlum is handicapped by the lack of long-term meteorological data, since prior to 1939 there was only one weather station in Afghanistan. Here, however, one can proceed with some assurance from first principles and from analogous stations in the U.S.S.R., Iran, and West Pakistan. Humlum himself characterizes any exposition on the climate of Afghanistan as a "thankless task" (p. 52), but I would accept his delineation of the climatic zones except for the inclusion of the Jalalabad Oasis in "Monsoonal Afghanistan." And since Dr. Humlum bases his classification of the natural regions of Afghanistan (map, p. 103) upon a correlation of climatology and orography, I believe that this issue is worth raising.

I would not quarrel with the inclusion of such areas as Khost, the upper valleys of the Kurram and Kaitu Rivers, and the upper valleys of the Gumal and Kundar Rivers in a "Monsoonal Afghanistan" region. These areas along Pakistan's North West Frontier all lie to the east of the so-called Western Suleiman Mountains which undoubtedly extract some moisture from the left flank of the Southwest Monsoon. I have experienced a few thundershowers in Kabul, at 5800 feet on the plateau, in the month of August, and both Kabul and Jalalabad exhibit a slightly higher rainfall for August than for June, July, or September. But apart from the few errant winds which may penetrate the high passes, both Kabul and Jalalabad are cut off from the monsoonal influence by the towering Safed Kuh range which has elevations of about 15,500 feet in the west, almost 15,000 feet due south of Jalalabad, and over 12,000 feet in the east near Peshawar. Northeast of Jalalabad, the lower Kunar Valley, also included by Humlum in "Monsoonal Afghanistan," is separated from the Peshawar-Swat region by the Hindu Raj range with peaks from 9000 to 12,500 feet high along the Afghan-Pakistan border.

Humlum's inclusion of the Jalalabad area and the lower Kunar Valley in

[3] Humlum indicates in a footnote to page 308 that he knows of this mapping program. I wrote to Fairchild in the summer of 1958 to ask whether any of the maps would be available and was informed that "all of this mapping is for the exclusive account of the Government of Afghanistan" (private communication, August 12, 1958).

"Monsoonal Afghanistan" is largely based upon a "double maximum" in the precipitation pattern (p. 105). But if one may judge from the *approximate* bar graphs of rainfall given by Humlum (p. 62), the summer maximum is insignificant in comparison with the winter maximum for both Kabul and Jalalabad, while it is highly significant for Peshawar, beyond the eastern end of the Safed Kuh, and for Parachinar in the Kurram Valley at the foot of these mountains.[4] While Peshawar receives almost 45 per cent of its precipitation in the Southwest Monsoonal period, and Parachinar 39 per cent, Jalalabad receives only 10.5 per cent in the four months from June through September, and Kabul some 6 per cent in this period. On the other hand, it is noteworthy that Jalalabad receives over 80 per cent of its rainfall from December through April, Kabul receives about 79 per cent in this period, and Peshawar and Parachinar get only 46 per cent and 48 per cent respectively. Thus it seems more accurate to leave the Jalalabad area out of "Monsoonal Afghanistan." Actually, the climate of Jalalabad is rather unique within Afghanistan, due to its low elevation and surrounding mountain ranges. With less than eight inches of rainfall, an almost dry summer, and infrequent frosts, the most appropriate classification would probably be BShs in the Köppen-Trewartha system: subtropical steppe, dry summer.

In all, Humlum devotes only 59 pages to the physical geography of Afghanistan. These include a five-page chapter on Vegetation, contributed by M. Køie, and two pages on Fauna. I was very pleased to find in the latter a reference to "des iguanes aux couleurs magnifiques, longs de jusqu'à 1 m" since few people believe me when I tell them I saw a yard-long rock lizard sunning himself in the Khyber Pass.

CULTURAL AND REGIONAL GEOGRAPHY

In the second and far longer section of his book, Dr. Humlum concerns himself with the human and economic geography of Afghanistan and in reference to settlement patterns and agricultural methods he really comes into his own. After a brief but excellent historical summary, he presents a series of adaptations of the map from *Sovietskaya Etnografia* no. 2, 1955 (reprinted in *Central Asian Review*, IV, no. 2, 1956), which together with the carefully written text and some fine photographs make the highly complex ethnographic and linguistic patterns of Afghanistan as clear as one could desire. The reader certainly appreciates the fact that the author indicates the possible margins of error in his figures and does not shun the frequent use of the question mark where the various estimates are somewhat doubtful.

I have already indicated that my only major disagreement with Humlum's divi-

[4] The following tabulation brings out the significant relations:

PRECIPITATION IN MILLIMETERS AND PER CENT

Station	*Dec.-Apr. Total*		*May*		*June*	*July*	*Aug.*	*Sept.*	*June-Sept. Total*		*Oct.-Nov. Total*	
	Mm	%	*Mm*	%	*Mm*	*Mm*	*Mm*	*Mm*	*Mm*	%	*Mm*	%
Jalalabad	153	80.5	12	6.3	4	4	9	3	20	10.5	5	2.7
Kabul	236	78.7	28	9.3	3	4	9	2	18	6.0	18	6.0
Peshawar	185	46.3	18	4.5	13	55	81	30	179	44.8	18	4.5
Parachinar	360	48.0	64	8.5	54	86	96	56	292	39.0	34	4.5

sion of Afghanistan into ten "natural provinces" concerns the inclusion of Jalalabad in "Monsoonal Afghanistan." The other regions: Wakhan, Badakhshan, Nuristan, East, South, Central, West, Northwest and North have much to recommend them. At the conclusion of this regional discussion, however, the author briefly mentions the administrative division of Afghanistan, stating that there are seven major provinces (Kabul, Mashriqi, Junobi, Kandahar, Herat, Mazar-i-Sharif, and Kataghan) and four secondary provinces (Ghazni, Farah, Parwan, and Badakhshan). No mention is made of Maimana Province, although it is shown on the provincial map (p. 113). At the very end of the chapter (p. 118) a more recent and presumably official map (text and legend are in Pushtu) is included, showing the present subdivision which includes Girishk and Shibarghan provinces for a total of fourteen (see map accompanying this article). That the earlier map and the text have not been brought into consonance with this Pushtu map, and with each other, is perhaps only editorial oversight, but it is certain to confuse the reader, especially as the Pushtu map is reproduced on the jacket of the book.

After a well-executed and beautifully-illustrated chapter on settlement patterns and housing types, Dr. Humlum presents a region-by-region description of the major towns and cities of Afghanistan. Where these are based upon visual impressions, the author's or those of others in the field, they are highly relevant and informative. Where, especially in northern Afghanistan which Dr. Humlum did not visit, they are based on map interpretations, they tend towards the superficial. But the quality of the photographs, sketches, and particularly the regional maps is uniformly high.

AFGHAN AGRICULTURE

It is when Dr. Humlum turns his attention to agriculture, in the 73 pages devoted to tenurial and crop patterns, crop types and varieties, agricultural implements, water rights, and irrigation practices, that he makes his most significant and original contributions in this reviewer's opinion. Here he is drawing largely on the results of his own careful observations while camping in the Pirzada oasis (between Kandahar and Girishk) in May and June of 1948. The product of his research[3] represents a considerable advance in our detailed knowledge of *karez* (*qanat or foggara*) irrigation in southwestern Afghanistan and the analogous areas of Iran and West Pakistan.

I can add nothing to Humlum's discussion of Pirzada, but I should like to underscore a few points which he makes in reference to Afghan agriculture in general inasmuch as these are essential to any understanding of the subject. For example, it is not generally realized that in Afghanistan, in contrast to Iran or West Pakistan, "There does not exist any considerable number of large-scale exploitations or large rural landholdings . . . and in any case it is not these which characterize rural property conditions" (Humlum, p. 163). Instead there exist a large number of middle-sized farms (20 hectares or over), whereas the great majority of holdings are of the order of two to ten hectares.

Dr. Humlum is willing to accept the FAO estimate that 4 per cent of Afghanistan is cultivated, excluding lands being fallowed which may amount to another 2.7 per cent. This estimate, as Humlum points out, is twice as great as that

[3] Previously available in part in the *Reports of the International Geographical Congress at Lisbon*, 1949, and also in a popular version in *Pirzada* (Copenhagen: Gyldendal, 1950) (in Danish).

made by Vavilov and Bukinich in 1929, and considerably less than the 13 per cent estimated by Wilber in the 1956 HRAF survey (though this *may* include fallowed lands).[6] I feel that Vavilov and Bukinich are somewhat closer in their estimate, but the important fact is that of the total area of Afghanistan (635,000 km² or 245,000 mi² according to Humlum) only between 2 per cent and 4 per cent is cultivated in a given season. Humlum, Vavilov, Wilber, and this reviewer, but not FAO, would agree that of the cultivated area very close to 50 per cent is irrigated. As for pasture lands, not sown, Humlum puts them at 50,000 km², Wilber at 32,000 km², and FAO has reduced its estimate from 250,000 km² (1953) to 32,140 km² (1957). I have no basis for adding an estimate of my own; this may be largely a matter of definition.

The clarity of Humlum's descriptions and illustrations of Afghan agricultural implements and harvesting, threshing, winnowing, and milling techniques does more to bring Afghan agriculture home to a Western reader than any yield statistics or generalized account could do. His chapter on irrigation methods is also excellent: detailed, graphic, and highly relevant whether or not one agrees that at least 10,000 km² (12,000 km² if the Helmand Valley Project lands in the Southwest are included) *must* be irrigated because otherwise there would be more than 12 persons per hectare of irrigated land,[7] the figure which prevails in Iran and which is already high in comparison with the 9 persons per ha. found in Egypt (Humlum, p. 204). Since the proportion of nomads or seminomads is higher in Afghanistan than in Iran and much higher than in Egypt, I am not sure that this sort of analogy is valid. But no reader can leave the discussion of irrigation methods in Humlum's *Afghanistan* without an enhanced appreciation of just how good the Afghan farmers are as irrigation engineers, considering the conditions and materials with which they have to work, an impression which is fully borne out by experience in the field.

[6] Pikulin (1956) estimates slightly over 2 per cent. This is a question which could be cleared up very nicely by interpretation of the Fairchild air-photo survey.

[7] Humlum estimates Afghanistan's population at only 8 to 10 millions rather than the 12 million usually given—all estimates including about 2 million nomads. No census has ever been made.

THE HELMAND VALLEY PROJECT

In turning from irrigation in general and that of Pirzada in particular to a discussion of the Helmand Valley multipurpose project, Humlum is forced to rely almost exclusively upon three sources: the Five Year Plan of Afghanistan, the Report of the Tudor Engineering Company which surveyed the project for the United States International Cooperation Administration, and the Human Relations Area File. All of these documents appeared in 1956, but the discussion in the Five Year Plan predates the Tudor Report and the 15 pages which the HRAF devotes to the project are based upon still earlier materials. Thus Humlum's treatment of the Helmand Valley Project is rather out of date in comparison with his discussion of indigenous agriculture, which changes very slowly.

Though the Tudor Report represents a very accurate and useful survey of the project in the summer of 1956, the Tudor group drew much of their information from reconnaissance surveys or partially-completed detailed soil and drainage surveys made by the Engineering Department of the American contractor for the project, Morrison-Knudsen Afghanistan, Inc., in Kandahar. These studies have since been completed and compiled in the form of the *Helmand*

Valley Survey Report: Soil and Water Resources of Southwestern Afghanistan. I was able to consult parts of the final draft of this report at the MKA offices in Kandahar in the fall and winter of 1957–58.[8] While the materials were still subject to revision either by the home office of MKA in San Francisco or by the Helmand Valley Authority in Kandahar, they represent a considerable improvement over the Tudor data and estimates. The student of Afghanistan's economic geography can only hope for their early publication.

In the interim, I cannot agree with Dr. Humlum's uncritical acceptance[9] of the Five Year Plan's estimate that over 91,000 families can eventually be supported on the project lands of the middle Helmand Valley (those now undergoing development). Even if we accept the Plan's *estimate* that 45,400 families were established in the project areas in June, 1955, I do not see how more than an additional 12,000 families can be added. I am especially skeptical (as was the Tudor Report) of the potential capacity of the poorly-drained Tarnak Area which the Five Year Plan puts down for an additional 10,000 families.

On the other hand, I certainly agree with Humlum's conclusion respecting the Helmand Valley Project which I would translate as follows: "One cannot yet say with certainty whether it will succeed and, if so, to what extent, but if all goes well it will inevitably serve as a model for other grandiose and far-sighted projects in other regions of the Middle East" (p. 261).

After an accurate but rather brief discussion of animal husbandry, Professor Humlum yields to Dr. Klaus Ferdinand, a member of the 1953–1954 Danish Mission to Afghanistan, who provides us with a chapter on the nomads of that country. The results of Dr. Ferdinand's field work are only beginning to appear, and this chapter represents just a preliminary sketch. But it is a very good one, giving us a convenient scheme for classifying the Eastern (Ghilzai) and Southern-Western (Durrani) nomads. One looks forward to further contributions, in greater detail, from Dr. Ferdinand on this absorbing subject.

MINERAL RESOURCES

Humlum's discussion of Afghan mineral resources and their exploitation is characteristically thorough but somewhat over-optimistic. Although he admits that Afghanistan's geology has been explored on only a very small scale (intentional double meaning), he feels confident that the country possesses "a large number of deposits of ores and other minerals of great economic value" (p. 299). I cannot agree that the deposits now known are at all remarkable for a nation of Afghanistan's size, and I certainly cannot go along with any line of reasoning which says that a country of that size must *ipso facto* contain large or valuable mineral deposits. The simple fact is that we just do not know enough, nor will we until a thorough geological survey is completed. We do know that neither the chromite deposits in the Logar Valley (south of Kabul), thoroughly investigated by M. E. Volin of the United States Bureau of Mines in 1949–1950, nor the

[8] See Aloys A. Michel, *The Kabul, Kunduz, and Helmand Valleys and the National Economy of Afghanistan* (Washington: National Academy of Sciences–National Research Council, 1959).

[9] On p. 256. In fact, nowhere in Humlum's book do I find any apprehension of the fact that, following the ministerial reorganization of July, 1957, the Five Year Plan (1956–60) was withdrawn and given to the newly-constituted Ministry of Planning for correction and revision. Even the revised plans can be regarded only as expectations or goals of the various ministries and of the Helmand Valley Authority since they do not, and hardly could, represent firm commitments and since there is no overall policing body to supervise execution of the plans.

beryl deposits at Darra Noor (northeast of Jalalabad) have proven commercially exploitable although sample exports of both have been made. The difficulty is not merely the cost of mining and transportation but the fact that apparently neither the quality nor the quantity of these ores is sufficiently high to attract interest in today's world minerals market.

Dr. Humlum is hopeful for the 2 to 3 million inferred tons of 64 per cent iron ore at Haji Alam near Kandahar. According to the *Helmand Valley Industrial Survey* (San Francisco: International Engineering Company, 1955) this would barely suffice for a small metallurgical operation, and coal might have to be brought from the Quetta area of West Pakistan. Humlum's suggestion that the potential hydroelectric power at the Kajakai Dam might be of use in the refining operation may best be deferred until we have the experience of the Aswan project to guide us; all indications are that Aswan will be completed before the Kajakai power installation.

Humlum's mention of the "probability" of constructing a blast furnace at Jabal-us-Seraj, about 40 miles north of Kabul, appears to stem from the Five Year Plan. But inasmuch as the nearest coal deposit to Jabal-us-Seraj is at Ishpushta, 100 miles away over a 9800-foot pass, and the nearest *cokable* coal probably at Kar Kar, almost 200 miles away over the same pass, this operation is also one for the distant future. In fact, the coal output of these two mines, the only ones now in commercial production, is already severely strained by the demands of the new cement plant at Jabal-us-Seraj and of the industries north of the Hindu Kush.

Humlum is also optimistic over Afghanistan's coal reserves, which he puts at 4 million tons for Kar Kar; 350,000 tons for Ishpushta; 15 million for Karrukh, northeast of Herat; and 6 million for Darra-Yusuf (or Darra-i-Suf), a virtually untouched site south of Mazar-i-Sharif. Of course, such estimation is difficult, especially where no shafts have been driven, but Paul Hamer of the United States Bureau of Mines, who worked with the Afghans at Kar Kar and Ishpushta for four years and who investigated the other sites, gave me estimates of indicated reserves of only 300,000 to 400,000 tons for Kar Kar and of only 100,000 tons for Ishpushta. For Karrukh, he inferred only 1.5 million tons, and for Darra-Yusuf, which he considered the only presently-known deposit capable of large-scale exploitation, he inferred about 5 million tons. The problem at Darra-Yusuf is that exploitation of the coal will entail the construction of either or both of two roads, the shorter of which is by far the more difficult. The Ministry of Public Works, which has started work on one of these roads, has other and more urgent projects which have priority, such as the completion of the Kabul-Khyber Pass Road and the construction of the Salang Highway which includes a 1.5 mile long tunnel under the 12,000-foot Salang Pass. But until Darra-Yusuf or some other quality field is tapped, Afghanistan will have to hobble along with an annual coal production which reached only 33,746 metric tons in 1958–1959 while the estimated national demand is already around 100,000 tons and the Jabal-us-Seraj cement plant alone requires 8000 tons per year.

With respect to petroleum, though it may be true that the oil-bearing strata of Iran and perhaps of Soviet Central Asia are represented in Afghanistan, the only evidence aside from various seepages has been provided by the limited success of two or three exploratory wells drilled in the area of Sar-i-Pul, south-

west of Mazar-i-Sharif. In 1957, with the aid of Swedish technicians under contract to the Ministry of Mines and Industries, corings were drilled to the depths of 817 and 850 meters. The first of these yielded samples of a heavy (s.g. 1.28) asphaltic petroleum; the second showed high pressure and petroleum below the level reached when drilling had to be halted for a lack of barite mud needed to maintain pressure in the well. When drilling was resumed, the Afghans had the assistance of Russian technicians provided under an agreement with Techno-Export, and a coring was carried to a depth of 1500 meters but without any publicized results.

Thus, although there may be "great possibilities" (Humlum, p. 300, footnote 3) with respect to petroleum in Afghanistan, it is too soon to build upon them. I agree with Humlum that ". . . nothing contributes more to the industrial exploitation of the potential mineral resources of a country than large deposits of good quality and easily accessible energy sources: coal and petroleum" (p. 299). But I have not yet seen evidence that Afghanistan can meet these conditions.

MANUFACTURING INDUSTRIES

Humlum's chapter on "Arts and Manufactures" is excellent as to the former (carpets, embroidery, pottery, utensils, harness, etc.) and also in an intermediate section concerning the utilization of hydroelectric energy which the author employs as a transition to manufacturing industries. But this last section, on machine manufactures, is probably the least satisfactory of the entire book, a result no doubt of the author's heavy reliance upon the original Five Year Plan and upon articles in *Afghanistan News*, a periodical published by the Royal Afghan Embassy in London. Not only does the author seem unaware of the tentative nature of the program set forth in the published Plan, but he tends to equate the beginning of a project with its continuance or completion and the placing of orders for equipment with delivery and installation.[10] These may be perfectly reasonable assumptions in Northern Europe, but they are not valid in Afghanistan, especially since the "Pushtunistan" border dispute with Pakistan may delay shipments from Karachi to Kabul for months at a time. Even shipments via the Soviet Union under the June, 1955, transit agreement may be delayed, and the assembly of materials and equipment, the erection of plants, the installation of machinery, and the recruitment and training of labor is, in Afghanistan as in many other nations, a painfully slow process. Dr. Humlum writes (pp. 302, 321) of the Czech-engineered cement plant at Pul-i-Khumri as though it were in operation, whereas it is still under construction, and he writes of enlarging a textile plant at Laghman (p. 328) where no textile plant exists.

On the other hand, industrial change does occur more rapidly than rural change, and the lack of recent field work probably explains the number of errors in this section on manufacturing as compared with the really splendid chapters on agriculture and irrigation. The author has confused the two textile plants at Jabal-us-Seraj (old and small) and at Gulbahar (brand-new and large) and has further confused the capacities of the Gulbahar and Pul-i-Khumri (recently enlarged) textile plants (pp. 324–328 *passim.*). Another point of confusion concerns the "Djagdalik" in-

[10] I was particularly distressed to note that in at least three tables (pp. 301, 328, 329) the author has published 1956–57 and 1957–58 figures taken from a *1956* source without any indication as to whether these are estimates or preliminary figures from a later source.

dustrial center referred to on page 302 and later described as situated six kilometers to the northwest of Kabul. "Djagdalik" is the name of a town on the Sarobi-Nimla road, correctly shown on Humlum's map, p. 109, and referred to on page 307 as a source of rubies.

The industrial center which the author has in mind is undoubtedly that at "Jangalak" in the southwestern part of Kabul city. This complex was originally established by a private company to make spare parts and other metal and wood items for sale. It includes a lumber mill, foundry, and cement-block plant. It makes truck and bus bodies of wood to be placed on imported truck chassis, as well as furniture and wooden boxes for fruit exports. In 1955, ownership was nationalized and in January, 1958, the Government authorized the use of a part of the Jangalak center for a vehicle repair shop to be equipped and supervised by Soviet Techno-Export. This development probably gave Humlum the impression that the entire center had been equipped by the Russians, but most of the original equipment is of German or British make and was privately procured by the Textile Company.

Aside from errors such as these, Humlum's account of Afghan industry is generally correct. The major omission appears to be no mention of the improvements made by the Consolidated Cotton Company at Kunduz between 1953 and the present time. The warehousing and processing facilities were rebuilt and enlarged, and new British-made cotton gins were installed. New facilities for processing cottonseed oil into cooking oil, fats, soap, and margarine were constructed. Every piece of the latter equipment, and every steel plate for the storage tanks, had to be brought from West Germany, most of it by way of the U.S.S.R. When I visited the site in September, 1957, the vegetable oil processing sections were still incomplete, and according to *Afghan Progress* (London: Royal Afghan Embassy Information Bureau, September, 1959) they are not yet in operation, such being the problems of supply, assembly, operation and maintenance in far-away places.

AFGHAN TRANSPORTATION AND TRADE

These sections of Humlum's work are much better than the preceding. The author might have devoted more than one sentence to the Kandahar International Airport[11] but perhaps he shares my skepticism as to how a field built to accommodate jet aircraft at a distance of over 700 miles from a port (Karachi) and over 60 miles from a railhead (Chaman) is to be supplied with sufficient quantities of fuel when it is in direct competition with the International Airport long in operation at that port and on the other end of that railroad.

I am also rather skeptical about the proposal which Humlum reports (p. 334) to put a road over the Hindu Kush from Jalalabad to Kunduz via the Kokcha Valley and about the construction of a ropeway over the Salang Pass north of Jabal-us-Seraj which he describes as under construction in 1956–1957 (p. 339). I saw no signs of it. I believe the plan is rather to build a tunnel under the pass, as mentioned above. Construction on the northern approach road from Doshi to Do Shakh has begun, with the U.S.S.R. supplying funds, equipment and engineers. If and when this most ambitious undertaking is completed, it will cut about 100 miles off the present route between Kabul, Jabal-us-Seraj,

[11] Page 333: "The project of a large international airport at Kandahar will cut two hours off the length of a flight from Europe to the Far East."

and Gulbahar on the one hand and Doshi, Kar Kar, and the industries of the Kunduz Valley on the other.

Humlum's discussion of Afghan domestic and foreign trade is good although he gives no quantitative import data except for cotton piece goods. This is rather surprising since the Ministry of Planning, from whose *Survey of Progress* (Kabul, 1958) much of Humlum's information is taken, had these data prepared before those on quantitative exports. At any rate, both Dr. Humlum and I owe a great deal to the young staff of this new Ministry who, with the able assistance of Dr. M. M. Hassanein of the United Nations Technical Assistance Mission in Afghanistan, collected, corrected, and compiled the first reliable data on Afghan foreign trade.

AFGHANISTAN AND SWITZERLAND

Dr. Humlum's conclusion comes as something of a surprise. Most authors writing on Afghanistan begin with a comparison between that nation and Switzerland. Dr. Humlum has saved his for the end. Needless to say, as Humlum demonstrates, the comparison is of very limited value. Not only is Afghanistan roughly 15 times the size of Switzerland, but it lies in a completely different physical and cultural context. While it is true that both nations have achieved their present political boundaries only within the last 150 years, the unity of Switzerland and the nationalism of the Swiss are far older motivations than those of Afghanistan and the Afghans. After all, modern Afghanistan dates only from 1747 when it was founded by Ahmad Shah Durrani (at Kandahar, not at Kabul as some seem to think). The banks of the Arghandab are a long way from the meadow at Rütli, just as 1747 is long after 1291. Though both Switzerland and Afghanistan are composite nations uniting various ethnic and linguistic groups, the variety is greater and the unity weaker in the latter. This has been recognized since the 1880's by the Kabul government which has relocated Turkic elements away from the northern boundary and sent Afghan (Durrani or Ghilzai) colonists to the north. This weakness is recognized today by the agitation over "Pushtunistan," Kabul maintaining that the peoples of the former North West Frontier Province, administered and tribal areas, should have been allowed self-determination in 1947—that is, to elect either for independence or for accession to their blood relations in Afghanistan where the true Afghans constitute less than a majority of the population.

Humlum's discussion of the Pushtunistan issue may not win him many friends in Kabul, but it is an honest and objective appraisal: "In any case, the Pushtunistan movement in Afghanistan has no political future. It is purely a dream" (p. 363). Humlum counsels the Afghans to cultivate the friendship of Pakistan since without transit privileges and access to the sea the economic future of Afghanistan, and particularly of the Helmand Valley, is in great peril. At the same time, he cautions that even cordial relations with Pakistan will not reduce the need for Afghanistan to tread softly alongside her powerful neighbor to the north. With this advice, Humlum concludes his study.

EVALUATION

In summation, it may be said that this substantial contribution by Johannes Humlum to the literature on Afghanistan is both long overdue and, paradoxically, premature. It is overdue in the sense that there has been no single work bringing together so much

information of Afghanistan's physical, cultural, and social geography. In this same sense, as well as in Humlum's own considerable additions to that information, it is a pioneer work. It is premature, however, in the sense that many of the primary sources of information are not yet developed to the point where a really satisfactory job can be done. In particular, the cartographic and statistical sources must be greatly improved before a completely definitive study can be made. Publication of the Fairchild maps, the *Helmand Valley Survey Report*, and of additional data by the Ministry of Planning will be of much help. But no one can adversely criticize the author of a pioneer work of this nature for not waiting even longer. Rather, Johannes Humlum deserves full credit for having taken this long-awaited step, and it is up to others (or to the author himself in a later edition) to build upon the foundation which he has so carefully and, by and large, so accurately prepared.

In the particular terms of reference of this article, Humlum's *Géographie de l'Afghanistan* is a perfect example of the difficulties of writing the geography of a strange land and a faraway place—one remote in distance and culture from the seat and society of the geographer. In awaiting the contributions of his fellow expedition members, in checking the large and often unrewarding bibliography, in making planimetric determinations, and in reworking his own notes, Humlum took 10 years from field work to publication. While wishing that the author had been able to spend more time in the field, or return to it closer to publication, this reader would still insist that the 10 years have been very well spent.

BOOK REVIEWS

Grasslands. A symposium presented at the New York Meeting of the American Association for the Advancement of Science, Dec. 27–30, 1956. Edited by HOWARD B. SPRAGUE. xv and 406 pp.; maps, ills., index. Publication No. 53 of the AAAS, Washington, D. C., 1959. $9.00. $9\frac{1}{4}$ x $6\frac{1}{4}$ inches.

Ah, the symposium! Despite its widely known defects—great variations in the level of treating the various topics, wide differences in style, omissions, repetition, contradictions—the symposium remains popular and useful because of one inestimable value: each topic can be treated expertly and authoritatively by one of the leading specialized workers in the field. So is it with *Grasslands*. The usual deficiencies of symposia are regularly and glaringly exhibited: technical terms are used with no explanation in an early chapter, and then explained in detail 200 pages later. One author carefully explains some of the most elementary concepts of chemistry, another assumes expert knowledge of biochemistry. And so on. But a reader interested in several specialized aspects of grasslands may turn to the appropriate chapter of this volume for a succinct account of each topic by one of the leading experts in the field.

The term "grasslands" in the title includes virtually any land on which grass grows—a golf green, the Great Plains, a dairy farm pasture in New York, a Rocky Mountain meadow, or a suburbanite's lawn. The volume's contents consist of invited papers designed, according to the editor's preface, "to provide a survey of the role which grasslands play in our national economy and a review of our knowledge relating to grasslands." The first of these objectives not only was not attained, it was not even attempted; the second is covered in spotty fashion.

The disparate assemblage of 37 papers has been grouped under eight major headings. Under the first heading, "Sciences in Support of Grassland Research," the contributions of plant exploration, plant pathology, plant physiology, genetics, ecology, pedology, and microclimatology to grassland research are described in a variety of ways by five authors. The second major subdivision, "Forage Production in Temperate Humid Regions," presents data on the latest developments in the economic and agronomic aspects of forage production in humid North America. A section devoted to "Engineering aspects of Grassland Agriculture" contains much detailed and highly specific information on machinery, storage equipment, methods, etc. Two sections are devoted to problems concerning the relationships among forage production, forage types, and the physiology of the animals that consume them. These are the most abstruse and technical sections of the volume, containing data on physiological and organic chemistry; but numerous straightforward, simple feeding experiments are also reported at length. These samples are sufficient to indicate the variety and diversity of the volume's contents.

The last three sections, a little less than half the volume, deal with data more familiar to geographers and of more interest to them. The three major topics are Grassland Climatology, Ecology of Grasslands, and Range Management.

The utility of the volume is epitomized in the article on "The Moisture Balance in Grassland Climatology" by J. R. Mather. It presents a concise summary of the moisture balance concept and a lucid explanation of the difficulties in measuring or calculating the balance, and it concludes with an explanation of the relationships between the moisture balance and grasslands. Most geographers will find all this familiar material; particularly those geographers whose interests lie in ecology, plant geography, agricultural geography, and similar topics. For someone unacquainted with the moisture balance concept, however, Mather's article constitutes an excellent introduction to and summary of the subject, and the short list of references at the end of the article furnish an adequate guide to further reading.

So it is with most of the other chapters, and few indeed are the geographers whose interests impinge on grasslands who will not find much of interest in several of the chapters of the last three sections. Erwin Biel presents, from his encyclopaedic knowledge of the climatic literature, numerous interesting data on the microclimates of grasslands. Some penetrating remarks concerning the relations of grazing intensity to various aspects of range management and improvement are included in a chapter by L. Ellison on "Rate of Plant Succession in Range Improvement."

The volume is not to be read straight through. Its topical diversity is so great that few readers will be interested in all the articles; still fewer will have the knowledge necessary to read them

all. Because many chapters summarize the current state of grassland science, the volume will probably pass out of date rather rapidly. In the meantime, however, it makes interesting and informative reading.

WESLEY CALEF

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Urban Problems and Techniques, Number 1, A Forum on Technical Problems in an Expanding Urban Society, PERRY L. NORTON, Edit. 249 pp.; map, tables. Chandler-Davis Publishing Co., Lexington, Mass., 1959. $4.50. 9½ x 5½ inches.

"It is basic to the function of the planning profession that, 'Its particular sphere of activity shall be the planning of the unified development or urban communities and their environs and of states, regions and the nation, as expressed through determination of the comprehensive arrangement of land uses and land occupancy and the regulation thereof.' " With this statement, taken largely from the Constitution of the American Institute of Planners, Perry L. Norton introduces what is intended to be the first of a series of occasional volumes concerned with *Urban Problems and Techniques*. The association of urban problems with planners carries through this book. Of the contributors ten are working planners, one a geographer, and the twelfth a political scientist. Another enumeration shows that three articles deal directly with "performance standards" as a part of industrial zoning, two with phases of zoning other than industrial, two with planning for recreation, three with the establishment and conduct of professional planning, and one each with the central business district and the implications of city annexation for the planner. Such a concern for the particular milieu of the planner, it is to be hoped, is not due to a belief that urban problems comprise only planning problems. No doubt Norton's former editorship of the *Journal of the American Institute of Planners* led him initially to look to planners but on future occasions we might hope for better balance among contributing urbanists.

Any geographer's assessment of the planner's view of urban problems must be based on an understanding of the contrasting roles assigned to the two professions. For us restraint inherited from assorted academic parentage is strong whereas for the planner born of the more confident fields of engineering and architecture certainty of goal is more characteristic. Scholasticism plagues geography at the same time that dogmatism plagues planning. This leads easily to our concern for questions of fact and causation and the planner's interest in action. To attempt the "determination of the comprehensive arrangement of land uses and land occupancy and the regulation thereof" it has been essential that the planner be equipped with "standards" which can be legally defended and with "concepts" sturdy enough to be proclaimed. If understanding fails between planners and geographers it usually gives way because of (1) the planner's concern with our absence of "standards" and "concepts," (2) the geographer's questioning of the wisdom of specific criteria such as these, and (3) the mutual failure to understand the part the other plays in the study and shaping of cities. This failure of understanding is to be regretted by both. The planner to accomplish the ordering of the future must turn to others to tell him the background of the realities of the present. The geographer to hope for the best development of his work must be set the goal of accomplishing work of actual concern to others than geographers. Some geographers balk at working to another's purpose but such an attitude overlooks the fact that serving as a foundation is honorable employment.

The tie between geography and planning is effectively shown by the single geographic study in this collection. Professor Murphy writes about the central business district as a foundation for planning with the knowledge that planners have used his work and its conclusions. Although in this volume the emphasis is on the precise application of a CBD delimitation technique to planning, in a geographic volume the work might be recast as a study of CBD growth and characteristics. In this way we see both the contribution and the independence of geography. Turning to the other papers in the book there can be little question as to the contribution but some as to the separability from the professionalism of planning. The papers dealing with the implementation of planning, notably the vaguely titled "Seeking Action Concensus Through Research," will not stimulate much interest among geographers but John Brewer Moore's "Toward Permanent Agrarian Greenbelts for the Garden State" should. Any proposal for the creation, through legal restraints on urban growth, of greenbelts raises several geographic questions: What types of agriculture normally or ideally should occupy these zones? How should these zones be located in relation to a major metropolitan area? To accomplish the basically aesthetic purpose of greenbelts is agricultural land the most desirable type for protection against urban encroachment? And the conservation-minded geographer might well inquire whether land still in private ownership, even under a system of no more than partial tax-forgiveness, would be as much an asset to society as to the holder of the agricultural rights?

This last question may be answered in part by the article of Kenneth B. Anderson, "How Important is Recreation Planning?", which represents a summary of a "user-resource" analysis of recreation needs published in greater detail elsewhere. The study, though carried

out in California, makes no mention of the greenbelts being undertaken in the Santa Clara Valley under state legislation, this despite the fact that Anderson was formerly planning director in the city of Santa Clara. The substance of this article and another along similar lines by Gregory Bassett of the University of Illinois is that recreation implies *access to land* rather than its simple observation. For this reason the questions posed above might well be considered by geographers. It seems quite probable that any justification for greenbelts may rest on grounds of economic rather than recreation geography.

A recurrent thread in all these articles, whether substantive as in the study of the CBD and Stephan Sussna's informative study of the legal status and functional contribution of trailer parks, or purposive as in the case of Maxine Kurtz' writing about the planning department's concern with annexation, in Denver, and two general articles on industrial performance standards (O. Wayne Noble, "Industrial Performance Standards: A Proposal," and Gordon Whitnall, "Attacking Smog Through Zoning") is that of mobility of urban population and its influence in reshaping the urban region. Yet notably in the planners' contributions we find quite diverse proposals for future development in terms of absolute objectives not apparently related to any fundamental understanding of the origin of urban geographical patterns. Returning to the distinction in goals between geographers and planners, it seems that this absence of foundation may be a call for more work by urban geographers.

It is to be hoped that subsequent volumes in this series will be more substantive in nature helping to fill this gap in our knowledge of the city as it exists. It may also be hoped that the future reading of printer's proof will find and correct the rather considerable number of obvious errors which jar the reader and leave him in doubt as to meaning in the worst cases.

J. E. VANCE, JR.

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Studies of Highway Development and Geographic Change, by WILLIAM L. GARRISON, BRIAN J. L. BERRY, DUANE F. MARBLE, JOHN D. NYSTUEN, and RICHARD L. MORRILL. xvi and 291 pp.; maps, ills., bibliogr. University of Washington Press, Seattle, 1959. $7.50. $10\frac{1}{2} \times 7\frac{3}{4}$ inches.

Not since the era of rapid expansion of the railroads in the mid-nineteenth century has a program of physical construction had as much potential impact upon the landscape of the United States as the system of express highways authorized by the Federal Highway Act of 1956. The 41,000 miles of Interstate highways already, although major construction is still ahead, is evidencing a tremendous effect upon the expansion of urban areas and the location of residences and business. As the construction accelerates in the next few years, the changes in the pattern of location of commerce and industry may be expected to proceed at a more rapid rate.

In spite of the potential impact of the new system of highways, those who have been concerned with its planning have been accused of giving too little attention to the relationships of the system to the physical and functional organization of the regions which it is to serve. The Highway Act of 1956 provides for research funds, to be administered by the U. S. Bureau of Public Roads through the various state highway departments, amounting to one and one-half per cent of the total budget for the system. Since, before its completion, the system is expected to cost nearly 50 billion dollars, with the Federal government paying 90 per cent of the cost, the funds available for research in the next few years will amount to many millions of dollars. Until now, most of the research financed under the Highway Act has been concerned with the engineering and design aspects of highways. Some research has been conducted, however, in accordance with the Act, upon the impact of highways upon the areas which they serve and through which they pass. Several studies have been carried on with funds made available as a result of the Highway Act, relative to the impact of highways upon the organization of human activities and land uses. The comprehensive transportation studies in a number of large metropolitan areas, which have recently been completed or are under way, include consideration of the functional organization of the areas and of their patterns of land use in relation to traffic generation. Such studies—among which those in the Detroit, Chicago, Washington, Pittsburgh, and Philadelphia metropolitan areas are perhaps the most noteworthy—are an inseparable part of the planning process, not only for the Interstate and other expressways, but also for the arterial street systems and for transit. These comprehensive transportation studies are only incidentally concerned with the basic reciprocal relations between transportation routes and the spatial organization of the respective metropolitan areas. There is, on the other hand, much interest in research of a more fundamental kind on the relations of highway transportation and land use. Several national conferences have recently been concerned with this topic. The Urban Research Committee of the Highway Research Board, which in turn is a part of the National Academy of Sciences–National Research Council, was formed to deal with these subjects, and for that committee Coleman Woodbury recently completed a comprehensive statement of research needs.

A few significant studies of the relations of circulation systems to urban land use and func-

tional organization have already been produced as a result of the availability of funds from the Federal Highway Act of 1956. Few of these studies have benefited from the participation of geographers. Among the most outstanding of such studies have been several made by members of the Department of Geography of the University of Washington, including those summarized in the present volume. These several studies, although independent, are closely related and together constitute a major advance in our knowledge of urban structure and the impact of highways in changing it. They represent a significant contribution toward the development of a predictive theory of urban structure and development. In addition, they are of practical value in urban planning, as they indicate some of the relationships that may be affected by the new highways.

A preliminary section of the volume is concerned with certain general concepts of the relations between highways on the one hand and land uses and functional organization of urban areas on the other. Special attention is given to the competition among businesses and the effects of improvements in highway access upon the service areas of various types of business establishments, the acceleration of urban deconcentration resulting from improvements in the highway system, and the increased centralization and concentration of certain types of establishments which require large thresholds of patronage, available only at larger centers where proximity of establishments and the consequent economies of scale mutually reinforce the attraction of all establishments in the center.

Most of the book is devoted to descriptions of a number of separate, but interrelated studies of the effects of highway changes, mainly in the State of Washington. The methods and findings of each of these empirical studies are described in some detail.

A major contribution of the volume is in Section II, by Brian Berry. This gives a general description of the spatial organization of retail and service functions within urban areas. It contains an important summary of previous studies of retail activities and land uses in cities generally, and includes brief reviews of the significance of both the theoretical and empirical work of many investigators in this field, including Rolph, Proudfoot, Ratcliff, Canoyer, Garrison, and others. The concept of the urban hierarchy is developed at some length, with particular reference to retail centers, and reference is made to such empirical and applied studies as those of Hoyt and Baker and Funero. This is followed by a description of those works which represent major contributions to the concept of the hierarchy of central places, with special reference to retailing and services. The theoretical models of such students of the subject as Christaller and Lösch are described.

Following the discussion of previous basic studies, Section II includes a detailed discussion of studies of the spatial organization of retail and service business establishments and clusters, exclusive of the central business district, made in Spokane, Washington, and a comparison of the results of that study with others made in Cedar Rapids, Iowa, Phoenix, Arizona, and Cincinnati, Ohio. A major advance in the Spokane study is the use of linkage analysis to establish the degree of clustering of establishments of different types. Thus the hierarchical organization of urban business types and clusters was clearly demonstrated. Two major types of establishments—those in the "automobile rows" and other highway-oriented businesses—are shown to be outside of the framework of hierarchically-organized business nucleations, and Berry makes a plea for the inclusion of these two types of business ribbons in city planning and zoning. In the Spokane study, methods of analysis of business clustering are developed which have wide applicability elsewhere, and adaptations of the methods are now being applied in a variety of other situations.

Another major study described in the volume relates to the effects of the opening of a new highway by-pass around a community. William Garrison describes an investigation of the changes that occurred in Marysville, Washington, with the completion of a new route which diverted the through traffic away from the community's main business street. He developed a series of indices of sensitivity of various kinds of business establishments to high way-induced change, in relation to patterns of customer travel, volume of sales, and changes in land values. He found great differences among the various kinds of businesses in their responses to the new by-pass route, with some establishments benefiting and others suffering. Although the removal of congestion from the community's principal business street facilitated access to many businesses, some lost patronage to a near-by larger city as a result of the faster and more convenient travel made possible by the new highway. Along with other studies which are cited in the book, the Marysville study demonstrated that improved transport accessibility favors the larger centers, which can thus extend their trade areas and enlarge their thresholds, thereby growing at the expense of formerly competitive smaller centers, which cannot as easily realize the economies of scale produced by larger accessible populations and purchasing power.

The effects of highway improvements upon land values and upon the generation of travel in residential areas is measured in a study by Duane Marble. As in the descriptions of most of the studies in the volume, the section includes a discussion of previous relevant publications. A detailed description is given of a study in Cedar Rapids, Iowa, in which Marble reached the conclusion that travel habits are more closely related to the economic and social characteristics

of households than to their spatial organization. The need for further research along these lines is emphasized.

Relations of customer travel to the various types of business establishments in Cedar Rapids are studied by John Nystuen, who contributes another major study to the volume. Nystuen, in general, confirms the existence of a hierarchy of business nucleations within the city. He demonstrates that the length of trips may increase with improved transportation, with the clear indication that the advantages of the larger nucleations are reinforced at the expense of the smaller ones of lower order. Customers, in other words, will take advantage of the better transportation in order to travel farther to clusters containing more and larger establishments with greater selection of goods and services, and where they can accomplish several purposes with the same trip.

One category of service—the medical services offered by physicians—constitutes a series of studies described by Richard Morrill in the final section of the book. Morrill investigated in detail the patterns of travel to and the utilization of physicians' services in three areas: Seattle, Cedar Rapids, and western Pennsylvania, with particular reference to the changes in service areas accompanying changes in the patterns of accessibility by highways. In these studies, as in the others throughout the volume, it was demonstrated that improvements in accessibility tend to favor the larger and higher-order nucleations in central cities and at major nodes in the highway network, where larger service areas and higher thresholds tend to increase the number and variety of specialized services.

While these studies represent substantial contributions to our knowledge of the reciprocal relations between transportation and the patterns of business nucleations, and between the accessibility of service areas and the associations which exist in business clusters, all of the authors, quite properly, point out that their studies are necessarily limited, and that a vast amount of additional empirical research is needed before the theoretical models which have been developed can be fully accepted. Nevertheless, it is becoming increasingly clear that the differential rates of growth, accelerated by highway improvements, tend to favor the larger and more complex centers, where routes converge, thereby maximizing accessibility and producing an extended service or trade area and therefore a higher threshold which can be taken advantage of by increasingly specialized types of establishments. Thus prospects for future growth of large metropolitan areas are generally very good, whereas the smaller communities in which the central-place types of functions predominate must make major adjustments to the new conditions if they are to survive.

The volume, in general, makes several major contributions to our knowledge of the relations between accessibility on the one hand and the functional organization of activities and land uses on the other. First, it demonstrates that transport-induced changes in areal organization of functions and land uses, although complex and far-reaching are, within limits, predictable, and it offers several methods by which such changes may be measured. Second, it demonstrates the tendency of larger and more complex central-places to grow at the expense of smaller ones of lower order. Third, it contains several important examples of the applications of geographic techniques and principles to practical problems, both of business planning and of management, and of public policy formulation with respect to areal development.

HAROLD M. MAYER

University of Chicago

The Geography of Iron and Steel, by NORMAN J. G. POUNDS, 192 pp.; maps and charts; Hutchinson University Library, London, 1959. 10s 6d net. $7\frac{1}{2}$ x 5 inches.

It has been noted that among the world's major industries the one that has received the greatest attention by geographers has been the manufacture of iron and steel. This is true in part because of the relatively simple relationships between the distribution of this industry and key locational factors. When a small volume appears such as this one on the Geography of Iron and Steel one might be tempted to dismiss it as merely a compilation of previous studies. Yet this reviewer must admit that this study, the work of one of the foremost students of the steel industry, is a significant contribution to the field and a meritorious addition to the Hutchinson series. The quality and quantity of material that has been packed into this small volume is surprising. There is much here not only for the general student of economic geography, but for the specialist as well. The "expert" on individual regional segments of the industry may quibble that some areas have received inadequate attention, but, in the overview, there is surprisingly little significant material, particularly on current developments, that has been omitted.

The study begins with a preface that emphasizes Pounds' own predilections in this field: "From among many possible lines of approach, the author has deliberately chosen the historical, seeing in the present pattern of industry a kind of palimpsest made up of the sequent patterns drawn over a period of several centuries." His basic organization encompasses such introductory chapters as: the art and science of iron working, the ores of iron, and the modern iron and steel works. These are followed by discussions of the iron and steel

industries of the United Kingdom, Western Europe, the United States and Canada, the Soviet Sphere, and the Underdeveloped Countries. Within the regional chapters, the author treats the developmental background of the industry, the resource base and its present locational pattern.

On the debit side, there is no separate chapter on the fuel base of the industry, although this topic is treated summarily in the section on the modern iron and steel works and in the various regional chapters. Although it must be admitted that the consumption of fuel in steel production has declined significantly in the past few decades, this element is still extremely important in the locational pattern. In addition, there is inadequate attention to the cost structure of the industry as it is related to the distributional pattern. Such an analysis would entail assessment of costs of assembly of raw materials and transportation of finished products to markets. These data are now available for most of the major iron and steel producing regions and would have been valuable aids in appraising the comparative advantages and disadvantages of the various producing districts. On another score, although a number of useful maps are included in the volume, their number, scale, symbolization, and identification of the places cited in the text leave much to be desired. Of course in a volume of this size, the problem of costs may have precluded some of these considerations.

In the overview, such secondary deficiencies are far overbalanced by the merits of this study. It is strongly recommended both for the general reader and for the specialist in economic geography.

ALLAN L. RODGERS

The Pennsylvania State University

People, Jobs and Economic Development: A Case History of Puerto Rico supplemented by recent Mexican experiences, by A. J. JAFFE. xix and 381 pp.; tables, charts, bibliogr., index. Published as a report of the Bureau of Applied Social Research of Columbia University by the Free Press of Glencoe, Ill., 1959. $6.00. 8½ x 6 inches.

Puerto Rico stands as a very special instance of economic development in our times, and, largely because of this, the commonwealth has probably received more attention from social scientists than any other piece of real estate of comparable size in the world. Hordes of anthropologists, sociologists, economists, geographers, political scientists, Point 4 experts, and sundry other types have descended upon the island, covering every foot of its 3500 square miles and poking into every nook and cranny of its social labyrinth. It has become the case study par excellence of every possible and impossible development program, and the literature dealing with the island fills an impressive array of bookshelves. Jaffe's effort is the latest addition to the collection, and like many of the previous studies it addresses itself to the question, "What can be learned from the Puerto Rican experience that might be useful for economic development elsewhere?"

Briefly stated, the basic thesis of Jaffe's work stresses that the most significant economic growth is that which improves the position of the individual in the nation. He warns that economic development can occur without necessarily creating more jobs or improving the plight of the worker. This disproves the assumption of much of the current analysis of economic growth which equates a rise in national per capita income or increase in the gross national product with improvement in the individual's well-being. Jaffe adequately supports his thesis with evidence from the Puerto Rico case history. His argument might have been strengthened by also measuring economic improvement in terms of income distribution in the population, but, unfortunately, information for this type of analysis was not available at the government agencies which supplied the author with the bulk of his data.

The book begins with an excellent foreword by Charles D. Steward of the United States Department of Labor, followed by a chapter stating the author's general thesis. The remainder of the volume is divided into two parts, the first of which deals with the Puerto Rican experience, and the second discusses the interpretation and possible application of this experience to other parts of the world. The second part also contains some observations on Mexico which the author uses to parallel the Puerto Rican study. The material on Mexico is so restricted, however, that the comparison is weak.

Jaffe is a sociologist with obvious competence in the fields of labor and population and with a strong grounding in economic theory. In line with this background he focuses his analysis primarily on demographic, labor force, and educational aspects, side-stepping such critically important considerations to economic growth as the role of natural resources, transportation, spatial factors, marketing, agriculture, and the methods of financing development. For the geographer who must keep the total picture of development before him, these omissions render the book too restricted in scope. Moreover, the analysis avoids considering precisely the type of material which is the basic food of geography. It is difficult to understand, for instance, why the role of agriculture is so lightly touched upon when this is the basic economy of virtually all areas concerned with development.

Jaffe's other shortcomings include a superabundance of statistics which makes for difficult

reading, and a tendency to belabor the obvious. Though the author is skillful in emphasizing only those aspects of the Puerto Rican development which may have universal application, it remains that the island's unequaled advantages stemming from its association with the United States leaves the reader to wonder whether any facet of the Puerto Rican experience is completely applicable to less favored areas.

Despite these shortcomings, the book serves a very useful purpose in disproving widely held misconceptions of the relation between national economic growth and the lot of the individual worker. It also brings out many socio-economic characteristics of underdeveloped areas which the geographer often overlooks, and it throws some light on the techniques of sister disciplines in dealing with economic studies of areas.

Jaffe's volume is recommended to two groups of geographers—those interested in the development of depressed areas and those who are searching for a bridge between economic geography and economics. In either case, however, the reader must be prepared to pan through much trying material to find some worthwhile nuggets.

JOHN P. AUGELLI

University of Maryland

International Resources and National Policy, by OLIN T. MOUZON. xiv and 731 pp.; maps, diagrs., bibliogr., index. Harper and Brothers, New York, 1959. $7.50. 9½ x 6 inches.

This is not a provincial book treating resources within the context of the domestic economy of a single nation. As the title indicates, resources are examined against a background of international economics and a great variety of organizations and institutions that influence the utilization and conservation of resources. The author disclaims any intention of making this work a source book or information about resources. Rather the factual material has been kept within modest bounds. It is policies, both national and international, that receive attention. After policies have been discussed at length conclusions and recommendations are presented.

In organization the book consists of three major units: One, Introduction; Two, Strength and Production Potentials; and Three, Strategy of Security. Unit One consists of a single chapter treating of objectives, policies, and resources. Unit Two consists of five major parts divided into 12 chapters. This comprehensive section of the book is concerned with spatial resources, agricultural production, international trade in agricultural products, energy resources, material resources, capital, and human resources. Unit Three, Strategy of Security, consists of two chapters devoted to geopolitics and related concepts and to military and economic security.

The international scope of the book is clearly indicated by many references to international trade and agricultural policies, to international concern for underdeveloped areas in the world, and to regional arrangements for collective security such as NATO, SEATO, SEESAW, the Rio Treaty, and the Anzus Treaty.

The reader will find that the author has given much more attention to geographical themes such as the size and shape of the earth, the nature of the seas, topography, location, climate, soils, and natural vegetation than most writers do unless they are professional geographers. In his discussion of agricultural production he recognizes the importance of the several environmental factors as well as the economic and political factors, both national and international, which affect the production of every agricultural commodity. Agriculture is more fully examined by a study of the international exchange of agricultural commodities. Significant topics include the rank of individual exports in relation to the total agricultural exports, the position of the United States as an exporter and importer of agricultural products, trade in complementary products such as rubber and coffee, trade in supplementary products such as sugar and wool, and the effect of tariffs, quotas, and other politico-economic devices on the international exchange of agricultural commodities.

In his treatment of the material resources of the earth and their utilization he recognizes the importance of location, exhaustibility, continued discovery, reserves, depletion, technological advances, increasing consumption, governmental policies, and international trade in mineral products. In this context of economic understanding he discusses at some length, coal, petroleum, natural gas, atomic energy, electric power, and the material resources such as iron, aluminum, copper, magnesium, lead, zinc, tin, cobalt, nickel, the other ferro-alloys, and a number of nonmetallic minerals. All of these materials are ranked in such a manner as to show the degree of adequacy of production to meet domestic needs, of the United States, the import of these essential products from the western hemisphere, and the degree of our dependence upon sources in the eastern hemisphere.

The last third of the book, or Part IV, consisting of five chapters, is concerned with conditions largely derived from man and his culture. These include capital, the mechanics of economic development, the nature of the labor force, the standard of living, military action, and international arrangements. In the final section the author reviews briefly the geopolitical theories of Admiral Alfred T. Mahan, Sir Halford J. Mackinder, Major General Karl Haushofer, and Professor Nicholas John Spykman. The book

is concluded with a brief but excellent discussion of national security.

The discerning reader will recognize a resemblance between this book by Professor Mouzon and *World Resources and Industries* by Erich W. Zimmermann. This is intended to be a compliment. Professor Mouzon's book is more timely because it bears the publication date of 1959. In content and in philosophy the book can be classified as an economic geography or perhaps more properly as a study in international economics. It is not narrowly a study of the conservation of natural resources though the problems of conservation receive attention. The fine bibliography covering 19 pages should prove most useful to other students of resources.

GUY-HAROLD SMITH

The Ohio State University

The Location of the Synthetic-Fiber Industry: A Case Study in Regional Analysis, by JOSEPH AIROV. xii and 203 pp.; graphs, maps, tables, appendices, index. Published jointly by the Technology Press of the Massachusetts Institute of Technology and John Wiley and Sons, Inc., New York, 1959. $9.75. 6 x 9 inches.

This study represents a significant refinement of a traditional approach to specific problems in industrial location. In brief, the procedure is to select a small number of locations and compute procurement, manufacturing, and marketing costs for various sizes of plants in each of them. There is a presumption that a manufacturer will be favorably disposed toward selecting the place in which these total costs per unit are at a minimum.

The computation procedure is complicated in the synthetic-fiber industry by the fact that different raw materials can be used to produce the same product. As a consequence, cost variations in the raw material "mix" must be computed for each location, so as to provide for a choice not only among locations, but also among raw-material combinations in those locations.

In studies of this nature, the selection of locations to be analyzed always appears to be somewhat arbitrary. In most cases, it is based on the judgment of some official in the firm for which the survey is being made, but in the present case it was made by the author, with a specific effort to select points that appeared to be favorably situated with respect to raw materials, markets, or labor. The merits of the study thus must lie essentially in the effectiveness with which it presents comparative case studies for these locations—which are in West Virginia, Texas, and Puerto Rico. That task, which entailed the manipulation of a large volume of cost data, has been performed effectively.

Geographers who are interested in the application of the techniques of differential cost analysis to the problems of locating individual manufacturing plants will find this study well worth perusal. Those who open the volume with the expectation of finding a distinct contribution to general location theory, or to that portion of general theory that is concerned with the synthetic-fiber industry, are likely to be disappointed. The study was designed to perform the former task, not the latter.

H. H. MCCARTY

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